Instruction Manual

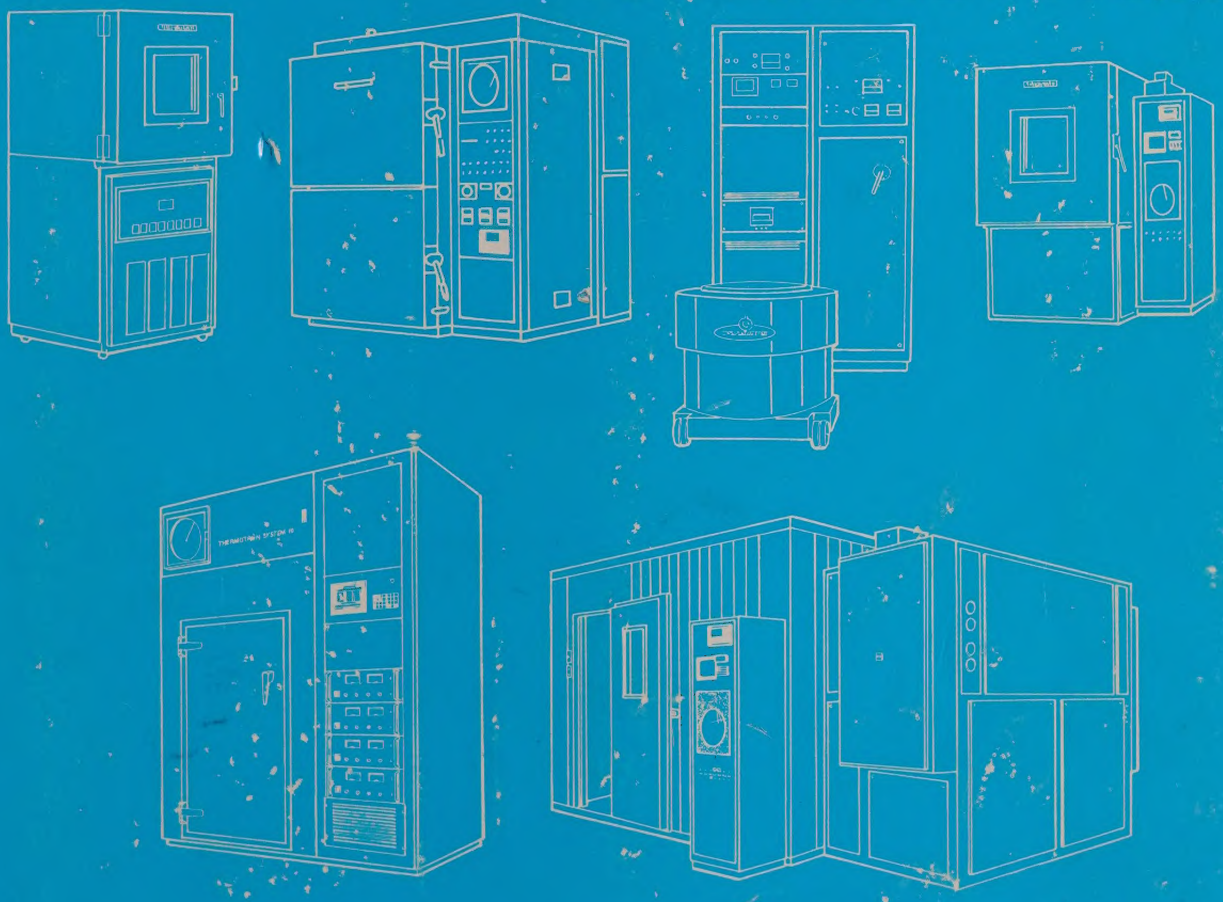
—For—

Thermotron Industries Testing System

Serial No. 12434

F-74-CHV-30-30

THERMOTRON



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THERMOTRON

THERMOTRON INDUSTRIES, INC.

SPECIFICATIONS

MODEL: F-74-CHV-30-30

F - Front door opening

74 - 74 cubic feet of work space

C - Cooling

H - Heating

V - Vibration

30-30 - A cascade refrigeration system

TEMPERATURE RANGE:

-73°C to +175°C

TEMPERATURE PERFORMANCE:

Cooling:

+138°C to -21°C @ 5°C/min avg. = 12.8 minutes

Heating:

-21°C to +43°C @ 5°C/min avg. = 13.8 minutes

SAFETY INSTRUCTIONS

For the safe operation of this machine, read and understand all warnings and cautions.

WARNING: **If you do not follow the instructions in a WARNING, injury can occur to you or to other personnel.**

CAUTION: **If you do not follow the instructions in a CAUTION, damage can occur to the equipment.**

1. You must have training in the operation of this equipment before using it. **Read the Instruction Manual.**
2. Do not operate this equipment unless it is completely assembled.
3. Maintenance and repairs must be done by authorized personnel only. Make calibrations according to the specifications given in this manual.
4. To prevent injury and damage, disconnect the electric power from the chamber before servicing.
5. In moving or relocating this equipment, never tip more than 45 degrees without special instructions from the manufacturer.
6. This equipment operates at extreme high and low temperatures. Human exposure to temperature other than ambient will cause damage.
7. High heat limit switches are for the protection of the equipment. High heat limit switches are not designed to protect the product on test.
8. The circulator (or blower) switch must be OFF whenever the chamber door is open.
9. If glove ports are used, do not leave the gloves in the test space when operation temperature exceeds +65.5 C (+150 F).

INSTALLATION INSTRUCTIONS

GENERAL INFORMATION:

The following pages of installation instructions are not meant to be exhaustive procedures detailing every aspect of installing this equipment. This section is meant to be used as a guide in installation as performed by personnel who are experienced in refrigeration and electrical work, and in working with heavy equipment.

INSTALLATION INSTRUCTIONS

LOCATING INSTRUCTIONS FOR AGREE CHAMBERS: (Refer to assembly drawing)

In order to effect an installation that will be permanently satisfactory, "AGREE" type test chambers should be securely fastened to the floor.

Over a period of time, temperature cycling within the chamber, combined with the effects of ambient vibration and temperature variations, can move the chamber out of its original position. This can stress plumbing and conduit connections, and may result in misalignment of the vibration test machine and chamber door.

Tie-down positions are provided on each chamber support leg. In addition, there are tie-down points on the machinery section. When the machinery section is remoted, all tie-down points should be used. When the machinery section is attached to the chamber, only the two outer machinery section tie-downs need to be used in addition to the chamber tie-downs. These tie-down points are also used for shipping. Note their position prior to removing the chamber from its shipping platform. The best method of lagging the chamber to the floor should be determined prior to locating the unit.

1. Locate the chamber and machinery section on a solid, level foundation, and attach the chamber to the machinery section in the event that they have been separated for shipping purposes. Shim base of equipment as necessary to make it level. In moving or relocating the equipment, never tip more than 45 degrees without special instructions from the manufacturer.

NOTE: Some systems are not equipped with a machinery section. If your system does not have a machinery section, disregard all references to machinery sections.

INSTALLATION INSTRUCTIONS

CHAMBERS WITH HINGED DOOR(S):

The following locating instructions apply to "AGREE" type chambers which are equipped with one or more hinged doors. The following instructions do not apply to "AGREE" chambers which are equipped with vertical lift doors.

1. Chambers with one (1) hinged door.

   Secure the chamber and machinery section to the floor in the sequence noted in the following steps, which also contain door alignment procedures.

   A. Secure the rear legs of the chamber to the floor.

   B. Raise the latch side of the door until it is approximately 1/8" higher than the body of the chamber. This will properly position the leg on the hinge side of the door.

   C. Secure the hinge side leg to the floor.

   D. Install the diaphragm or floor plug. Verify that there is proper clearance between the diaphragm or floor plug and the diaphragm rails.

   E. Secure the leg on the latch side of the chamber to the floor. With the chamber securely anchored, the door should be checked for proper closing and operation.

   F. Secure the machinery section* to the floor. If the machinery section is remoted, use all tie down points. If the machinery section is attached to the chamber, use only the outer machinery section tie down points.

* Some testing systems are not equipped with a machinery section.

2. Chambers with two (2) hinged doors.

   Secure the chamber and machinery section to the floor in the sequence noted in the following steps, which also contain door alignment procedures.

   A. Raise the latch side of each door until each door is approximate 1/8" higher than the body of the chamber. This will properly position the legs on the hinge side of each door.

   B. Secure the hinge side legs to the floor.

   C. Install the diaphragm or floor plug. Verify that there is proper clearance between the diaphragm or floor plug and the diaphragm rails.

   D. Secure the legs on the latch sides of the chamber to the floor. With the chamber securely anchored, the doors should be checked for proper closing and operation.

INSTALLATION INSTRUCTIONS

CHAMBERS WITH HINGED DOOR(S):

E. Secure the machinery section* to the floor. If the machinery section is remoted, use all tie down points. If the machinery section is attached to the chamber, use only the two outer machinery section tie down points.

* Some testing systems are not equipped with a machinery section.

INSTALLATION INSTRUCTIONS

CHAMBER WITH VERTICAL LIFT DOOR(S):

The following instructions apply to "AGREE" type chambers which are equipped with one or more hoist operated vertical lift doors. The following instructions do not apply to "AGREE" chambers which are equipped with hinged doors.

1. Secure the machinery section to the floor. If the machinery section is remoted, use all tie down points. If the machinery section is attached to the chamber, use only the two outer machinery section tie down points.
2. Do not secure the chamber to the floor at this time unless your chamber is equipped with a single hoist door and a remote machinery section. When this is the case, secure the chamber to the floor, using only the two rear tie down points at this time.

Most chamber doors of this type are equipped with manually operated door clamps. With doors of this type, DO NOT loosen the door clamps until the installation of each hoist and hoist support assembly is completed. Chamber doors which have pneumatically operated door clamps instead of the manual type MUST NOT be loosened from their shipping positions until the installation of each hoist and hoist support assembly is completed.

3. Referring to the assembly drawing, the electrical schematic, and the hoist manual, install each hoist support assembly and hoist, with the following exceptions: Do not yet provide main power supply, do not yet attach the hoist hook(s) to the chamber door(s), and do not unclamp the door(s), or remove the door(s) from shipping position.

No further installation in this area should be attempted until after all necessary electrical connections and interconnections have been completed. After performing the necessary electrical connections and interconnections according to the applicable electrical installation procedures in this section, proceed to further installation instructions for chambers with vertical lift door(s) as detailed later in this section.

INSTALLATION INSTRUCTIONS

CHAMBERS WITH ONE HINGED/ONE VERTICAL LIFT DOOR:

The following instructions apply to "AGREE" type chambers which are equipped with one hinged door and one hoist operated vertical lift door.

1. Raise the latch side of the hinged door until it is approximately 1/8" higher than the body of the chamber. This will properly position the leg on the hinge side of the door.
2. Secure the hinged side leg to the floor.
3. Install the diaphragm or floor plug. Verify that there is proper clearance between the diaphragm or floor plug and the diaphragm rails.
4. Secure the leg on the latch side of the hinged door to the floor. Check the hinged door for proper closing and operation.
5. Secure the machinery section to the floor, using the tie down points provided.

   NOTE: Some testing systems are not equipped with a machinery section.

Most hoist operated vertical lift doors are equipped with manually operated door clamps. For doors of this type, DO NOT loosen the door clamps until the installation of the hoist and hoist support assembly is completed. Doors which have pneumatically operated door clamps instead of the manual type MUST NOT be loosened from their shipping positions until the installation of each hoist and hoist support assembly is completed.

6. Referring to the assembly drawing, the electrical schematic, and the hoist manual, install the hoist support assembly and hoist, with the following exceptions: Do not yet provide main power supply, do not yet attach the hoist hook to the chamber door, and do not unclamp the door, or remove the door from its shipping position.

No further installation in relation to the vertical lift door should be attempted until after all necessary electrical connections and interconnections have been completed. After performing the necessary electrical connections and interconnections according to the applicabl electrical installation procedures in this section, proceed to further installation instructions for chambers with vertical lift door(s) as detailed later in this section.

INSTALLATION INSTRUCTIONS

CIRCULATOR MOTORS:

In the event that the circulator motor(s) have been removed for shipment, the following instructions will aid in the re-installation of the circulator motor(s).

Secure a supply of Permagum, or similar non-hardening caulk. Refer to the bottom side of the circulator motor mounting plate, and drawing 621-A(Z). Apply a continuous bead of caulk around the bottom of the mounting plate just inside these bolts. The zig-zag line on drawing 621-A(Z) shows where the caulk is to be applied. Secure the mounting plate-circulator motor assembly to the chamber with the (4) bolts provide

FAN BLADE INSTALLATION:

With the fan hub down, or toward the installer, slide the fan blade up the shaft. Position so that the set screw which is in the fan blade is adjacent to the flat side of the shaft. Thread the screw until snug against the shaft, but do not securely tighten at this time. Install onto the shaft below the blade, the flat washer, lock washer, and nut provided. Securely tighten the nut. Then securely tighten the set screw in the fan blade.

BLOWER WHEEL INSTALLATION:

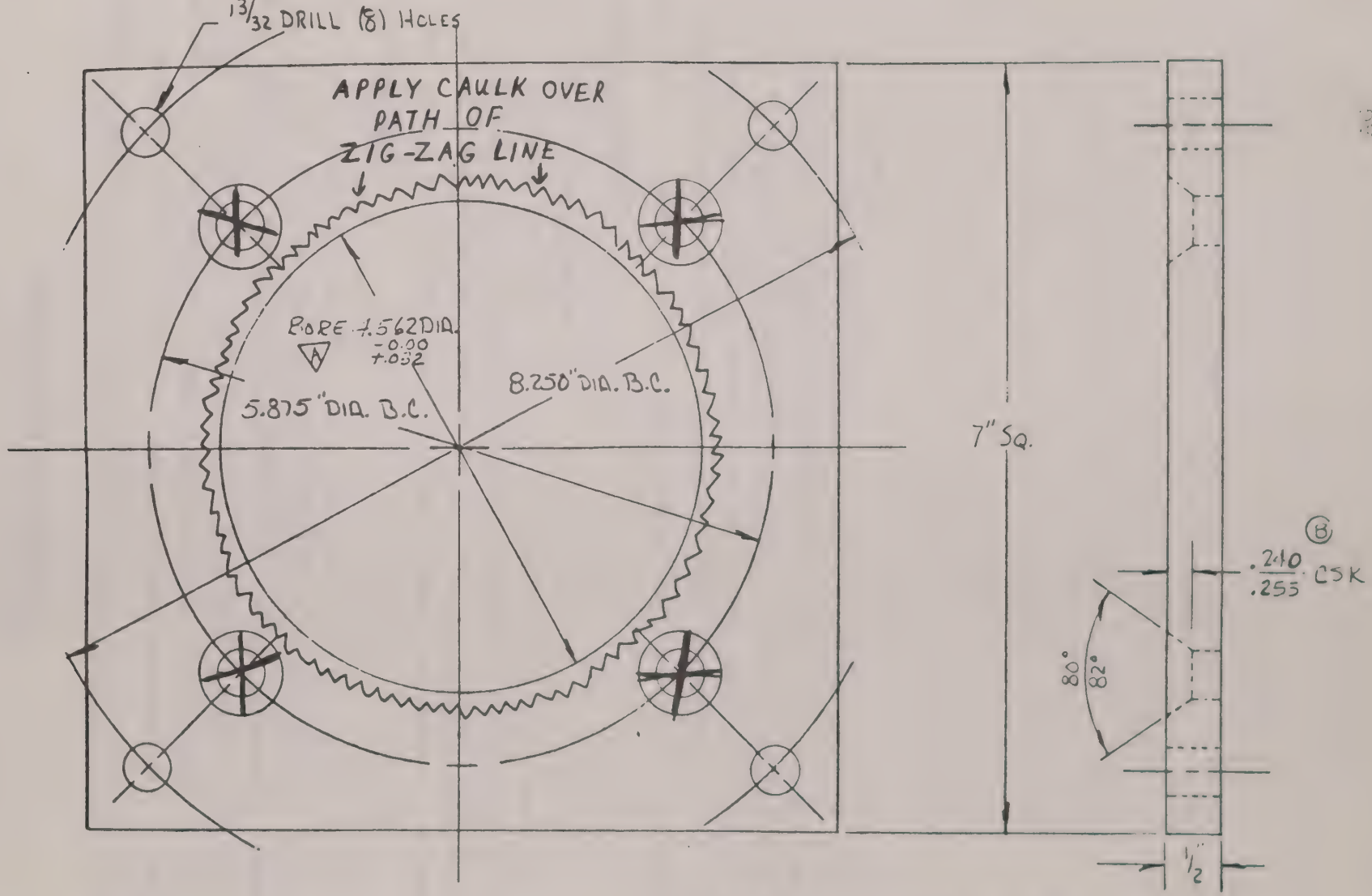
Slide the blower wheel up the shaft. Position so that the set screw which is in the blower wheel is adjacent to the key. Thread the set screw until snug against the key, but do not securely tighten at this time. NOTE: There is provision in the blower wheel for installing a second set screw, but the second set screw should not be installed for this application. Install the flat washer provided onto the shaft below the blower wheel and install the retaining bolt into the shaft. Securely tighten the bolt. Then securely tighten the set screw against the key.

ELECTRICAL CONNECTIONS:

Remove the circulator motor electrical box cover plate. Insert the conduit provided through the hole in the box, and secure to the box with the conduit fitting provided. Find the wire(s) coming from the circulator motor. Using wire nuts or equivalent, connect the like numbered wires. (For example, wire C1 to wire 1.) Replace the electrica box cover plate.

ART NO. 021-A | Z

INST 8



ST9987 STD. W.O.#

SYM	DATE	CHANGE	BY
A	6-A-79	WAS 4.5 BORE	M.S.
B	.240/.255	WAS .230 MIN.	H.B.

SYM	DATE	CHANGE	BY
C			
D			

MATERIAL 1/2" BLACK PHENOLIC XX PAPER BASE

THERMOTRON CORP.
HOLLAND, MICHIGAN U.S.A.

DRAWN BY | DATE | SCALE | APPROV.

INSTALLATION INSTRUCTIONS

QUIET PACKAGE (SOUND DEADENING ASSEMBLY):

In the event that this testing system is equipped with a 540 quiet package, and it has been removed for shipment, re-install as follows. Connect the wires or insert plug into receptacle, as applicable, per the electrical schematic. Apply caulk all around between vent package and machinery section, and secure the quiet package assembly to the machinery section.

THERMOTRIMMER:

In the event that this testing system is equipped with a Thermotrimmer (high temperature stabilization unit), and it has been removed for shipment, re-install, referring to the drawings in this manual, and to the Thermotrimmer manual. All refrigeration line connections must be silphos soldered.

OTHER COMPONENTS:

Referring to the drawings in this manual and to the associated OEM literature, when applicable, re-install any other components which have been removed for shipment. In the event that the chamber and machinery section have been separated for shipment, make the necessary electrical and refrigeration connections between the chamber and the machinery section. All refrigeration line connections must be silphos soldered.

INSTALLATION INSTRUCTIONS

ELECTRICAL INTERCONNECTIONS:

1. Console to Chamber and/or Machinery Section.

   When a testing system is equipped with a console, the console must be interconnected to the chamber and/or machinery section. The console is equipped with flexible conduit. This conduit, along with interconnect wiring, is shipped with the console end attached. Proceed as follows in performing console to chamber and/or machinery section interconnections.

   A. Place the console in a position that will allow the conduit to reach the electrical panel.

   B. Insert the wire ends and attach the conduit to the electrical panel.

   C. Connect the wires to the terminals in the electrical panel, matching each wire number to the same number terminal.

   D. Connect the sensor extension wires (located on outside of flexible conduit) to the correct terminals on the sensor terminal block, which is located on top of the chamber. (Refer to instrumentation drawing.)

2. Remote Machinery Section to Chamber.

   When a testing system is equipped with a remote machinery section, the machinery section electrical panel must be interconnected to the chamber terminal junction box. Make sure that the wire is cut sufficiently longer than the conduit to allow the wire to reach the proper terminals. It is strongly recommended that all wires be numbered per the electrical schematic prior to being passed through the conduit.

   A. Verify that the chamber and the remote machinery section are both secured in the proper locations.

   B. Install conduit from the machinery section electrical panel to the chamber junction box.

   C. Refer to the appropriate interconnect data on the electrical schematic for the wire sizes, colors, and identification numbers. Cut the correct wires, making certain that each wire is sufficiently longer than the conduit run. Number the wires.

   D. Run the wires through the conduit.

   E. Connect the wires to the chamber junction box, matching the wire numbers to the same number terminals.

INSTALLATION INSTRUCTIONS

ELECTRICAL INTERCONNECTIONS: (Continued)

F. Connect the wires to the machinery section electrical panel, matching the wire numbers to the same number terminals.

3. Remote Air Cooled Condenser to Machinery Section.

When a testing system is equipped with a remote air cooled condenser, the air cooled condenser must be interconnected to the machinery section electrical panel. Make sure that the wire is cut sufficiently longer than the conduit to allow the wire to reach the proper terminals. It is strongly recommended that all wires be numbered per the electrical schematic prior to being passed through the conduit.

A. Locate and secure the remote condenser in the required location.

B. Install conduit from electrical panel to the remote condenser disconnect switch.

B. Cut the correct wires, making certain that each wire is sufficiently longer than the conduit run. Number the wires.

D. Run the wires through the conduit.

E. Connect the wires to the electrical panel, matching the wire numbers to the same number terminals.

F. Connect the wires to the remote condenser disconnect switch, per the electrical schematic.

NOTE: Occasionally the remote air cooled condenser will operate from a power source which is separate from the main system power source. When this is the case, provide the appropriate power supply to the air cooled condenser per the electrical schematic instead of interconnecting the condenser to the machinery section.

4. Console to Shaker Console Assembly.

When a Thermotron shaker is provided in conjunction with a chamber testing unit, the chamber console must be interconnected to the shaker console assembly. Referring to the assembly drawing, the electrical schematic and/or the instrument wiring diagram, and the shaker manual, make the necessary interconnections between the chamber console and the shaker console assembly.

5. Customer Use Connections.

Some testing systems require that customer interface electrical connections be made. Referring to the electrical and/or instrumentation schematic, make any necessary customer interface connections.

INSTALLATION INSTRUCTIONS

ELECTRICAL INTERCONNECTIONS: (Continued)

6. Referring to the electrical schematic and assembly drawing, make any other necessary electrical connections or interconnections which have not been covered in steps 1 - 5.

7. Verify that all necessary electrical connections and interconnections have been completed. When this is verified, provide proper main power supply per the electrical schematic.

INSTALLATION INSTRUCTIONS

CHAMBERS WITH VERTICAL LIFT DOOR(S):

Each hoist should be tested to make sure that it is properly phased. Referring to the hoist manual, perform the phasing check. When the phasing has been confirmed to be correct, attach the hoist hook(s) to the chamber door(s). Before proceeding further, verify that all hoist related installation is completed. Also, study the operation section of the hoist manual.

For the door(s) to operate properly, the chamber must be squared. The chamber is square when the vertical lift door(s) operate without riding on either of the vertical uprights. The clearance on the sides of the door(s) should be approximately equal. * Carefully loosen the door(s) from their shipping positions and perform the preceding checks. Shims may be placed under the appropriate chamber legs, if necessary, in order to square the chamber. Recheck the chamber door to verify proper door alignment. When this is verified, secure the chamber to the floor, using the available tie down points.

* NOTE: If your chamber is equipped with a single hoist door and a remote machinery section, the side of the chamber opposite the hoist door must already be attached to the floor, as noted previously. For personnel safety reasons, the door on this type of chamber must not be raised unless the chamber is partially secured to the floor as noted. When it is verified that the chamber is square, secure the hoist side of the chamber to the floor, using the tie down points provided.

INSTALLATION INSTRUCTIONS

DIAPHRAGM/FLOOR PLUG

The bottom of an AGREE type chamber is constructed as a vibration port, which will accommodate either a diaphragm or a solid floor plug. It is very important that the diaphragm or floor plug be properly sealed against the chamber in order to minimize thermal transfer and the resultant frost build-up. The diaphragm or floor plug must be properly positioned between the front and rear of the chamber. If your chamber is equipped with a front door only, adjustable backstops are provided, and they must be positioned so that the diaphragm or floor plug is flush with the front of the chamber. If your chamber is equipped with both front and rear doors, the diaphragm or floor plug must be positioned so that it is flush with the front and the rear of the chamber. The diaphragm or floor plug must also be centered between the sides of the chamber. Adjust the diaphragm clamps as necessary to allow the clamps to effectively seal the diaphragm or floor plug against the chamber.

INSTALLATION INSTRUCTIONS

REFRIGERATION: (Refer to assembly drawing and refrigeration schematic.)

1. Remote Machinery Section Interconnection.

   When a testing system is equipped with a remote machinery section, refrigeration line interconnections must be made between the chamber and the machinery section. All connections must be silphos soldered. Trap all vertical lines and reduce suction risers by one pipe size. Slope horizontal runs one inch per ten feet toward the machinery section. Connect the refrigeration lines from the chamber to the machinery section, using appropriately sized copper tubing, elbows, and couplings.

2. Remote Air Cooled Condenser Interconnection.

   When a testing system is equipped with a remote air cooled condenser, refrigeration line interconnections must be made between the condenser and the machinery section. All connections must be silphos soldered. Connect the refrigeration lines from the machinery section to the remote condenser, using approximately sized copper tubing, elbows, and couplings.

When either or both of the interconnections described in items 1 and 2 have been carried out, perform steps 3 - 5.

3. Leak test the joints which were soldered after shipment.

4. Install refrigeration piping insulation where applicable.

5. Evacuate the system. A small portable vacuum pump built specifically for refrigeration evacuation should be used. Do not use the refrigeration compressor as a vacuum pump.

Determine applicability and perform steps 6 and 7 whether or not the previous steps have been applicable.

6. Remove or loosen shipping retainers under compressors, and install the supplied grommets. (Not applicable when compressor is rigid mounted internally instead of spring mounted externally.

* 7. Check compressor oil level in sightglass. In Copeland compressors, the oil level should be at, or slightly above, the center of the sightglass. In Carlyle compressors, the oil level should be between 1/8 and 3/8 up the sightglass. If it is necessary to add oil, use 3G refrigeration grade oil.

* Not applicable to hermetically sealed compressors.

INSTALLATION INSTRUCTIONS

PLUMBING: (Applicable to water cooled systems only.)

Provide and connect water supply to water inlet, line size equal to or larger than inlet fitting provided. Connect drains to waste water line. Do not make final connections to water inlet fitting until any newly-installed line has been flushed thoroughly to remove any pipe compound, metal chips, or foreign matter. When more than one test unit is operated, be sure the water supply and draining lines are large enough to handle the combined water requirements.

Water pressure on an open drain type water cooling system shall be a minimum of 35 lbs. and a maximum of 100 lbs. On any type of closed system where the outlet (drain side) is not open, the OUTLET pressure is NOT TO EXCEED 50 lbs.

NOTE: Allow sufficient space around the equipment for servicing.

INSTALLATION INSTRUCTIONS

DRY AIR PURGE:

If your testing system is equipped with a dry air purge system, connect a clean, dry supply of air to the air inlet provided. This must be a maximum of 100 P.S.I.G. and a minimum of 60 P.S.I.G. (13 SCFM maximum at 100 P.S.I.G.) In the event that the purge system is located remote from the chamber, make the necessary purge line interconnections.

HUMIDITY SYSTEMS:

If your testing system is equipped with a humidity system, refer to the humidity section and/or humidity drawing or assembly drawing included in this manual for the humidity water requirements.

AIR SUPPLIES:

If your testing system is equipped with a pneumatic control system, or any other type of system which requires an air supply, refer to tha applicable drawing and make the air provision accordingly. If your testing system is equipped with pneumatic diaphragm clamps, the diaphragm may be clamped into position by actuating the diaphragm clamp control valve until clamping is achieved. Also make any necessary air line connections or interconnections.

INSTALLATION INSTRUCTIONS

ECA FLOW:

If your testing system is equipped with an ECA (equipment conditioning air) mechanism, make any necessary air flow or air flow sensor line interconnections, referring to the drawings included in this manual.

LN_2 COOLING:

If your testing system is equipped with an LN_2 cooling system, connect a clean dry supply of LN_2 at 30 P.S.I.G. to the LN_2 inlet(s) provided. (Insulate the piping from the supply to the LN_2 valve.)

NOTE: A high pressure relief valve should be connected to this line to relieve pressure if LN_2 is trapped in the line.

Connect an LN_2 vent exhaust line (of a diameter equal to or greater than diameter of vent) to the vent connection provided. The line should be as short as practical and with as few bends as possible, to prevent back pressure.

CO_2 COOLING:

If your testing system is equipped with a CO_2 cooling system, connect a clean, dry supply of CO_2 to the CO_2 inlet(s) provided. It must be determined whether the CO_2 supply is to be 300 P.S.I.G. or 1,000 P.S.I.G. Refer to the CO_2 parts list and drawing to make this determination.

NOTE: A high pressure relief valve should be connected to this line to relieve pressure if CO_2 is trapped in the line.

Connect a CO_2 vent exhaust line (of a diameter equal to or greater than diameter of vent) to the vent connection provided. This line should be as short as practical and with as few bends as possible, to prevent back pressure.

GN_2 SUPPLY:

If your testing system is equipped with a GN_2 purge system, connect a supply of GN_2 at 100 P.S.I.G. maximum to the GN_2 inlet provided. Connect a GN_2 vent exhaust line (of a diameter equal to or greater than diameter of vent) to the vent connection provided. The line should be as short as practical and with as few bends as possible, to prevent back pressure.

INSTALLATION INSTRUCTIONS

START UP PROCEDURE:

In the event that this system is to be started up by non-Thermotron personnel, it is important that those performing the start-up be experienced in electrical and refrigeration work. The following instructions will assist in starting up the equipment.

NOTE: If your system is not equipped with a refrigeration system, disregard all procedures related to refrigeration systems.

Electrical:

1. Verify that the input line power is the same as is called out on the electrical schematic.
2. With the power OFF, open the electrical panel and verify that there are no loose connections.

Refrigeration:

NOTE: If your testing system does not have an R-13 system, disregard step 3.

1. Take off all panels which enclose refrigeration valves, and backseat (open) all valves that have a red tag attached. Refer to preventive maintenance section for further clarification of the backseat position. As each valve is opened, or backseated, rip off the red tag. This will provide indication that the valve has been backseated.

NOTE: Tighten service caps and packing glands to prevent leakage.

2. When applicable, verify that the shipping blocks have been removed from under the compressors, and that the supplied grommets have been installed.

* 3. Verify that the R-13 standby pressure is at the factory R-13 standby pressure recorded on the equipment serial tag. Following is an explanation of the standby method.

The R-13 system of the Thermotron cascade unit is charged by the "standby" method. The factory R-13 standby pressure is recorded on the equipment serial tag. This will allow a comparison to the present R-13 standby pressure in the system.

To read the R-13 standby pressure properly, two requirements must be met. First, the entire R-13 system (including the cascade) must be at or near ambient temperature. (70°F or 21°C.) Secondly, the R-13 system must be equalized. After the system has been equalized, the standby pressure may be read on the R-13 discharge pressure gauge. If the gauge reading is approximately that of the recorded standby pressure, the system will meet the designed requirements.

* See preventive maintenance section for charging instructions.

INSTALLATION INSTRUCTIONS

START UP PROCEDURE:

Refrigeration: (Continued)

4. Leak check the refrigeration system, specifically checking the expansion valves and the evaporator coil.

"System on" Procedures: (Have an amprobe ready)

NOTE: Prior to attempting to perform the "SYSTEM ON" procedures, it is necessary that the individual(s) performing the start-up carefully study all OEM literature, and the operating instructions in this manual.

1. Turn all function switches to OFF position and close door switches.
2. Turn the MAIN DISCONNECT switch ON. (If applicable)
3. Turn the PILOT switch ON, and verify that it is operational.
4. Turn the LIGHT switch ON, and verify that is is operational.
5. Turn the CIRCULATOR switch ON.
   A. Visually verify that circulator motor is running.
   B. With an amprobe, check circulator current.
      NOTE: Carefully check all three legs of three phase circulators. If one leg is drawing excessively higher amperage than the others, there is danger of single phasing and burning out the motor.
   C. When the circulator motor is three phase, check for proper air flow directions. Direction of air flow can normally be assumed correct if maximum discharge is over the instrument control sensor.
6. Check the instrumentation; verify no damage or loose connections.
7. Select a relatively high set point on the applicable instrumentation. The set point must be high enough that there will be a demand for heat. Program instrumentation, as necessary, for heat.
8. Turn the HEAT switch ON.
   A. With an amprobe, check heater current. (Check all three legs if heater is three phase.)
9. Select a low set point on the applicable instrumentation. The set point must be low enough that there will be a demand for cooling. Program the instrumentation, as necessary, for cooling.
10. Verify that the condenser water supply is ON. (Water cooled systems only)

INSTALLATION INSTRUCTIONS

START UP PROCEDURE:

"System on" Procedure:

11. Depress the REFRIGERATION RESET pushbutton, when applicable.
12. Turn the COOL switch ON.
13. With an amprobe, check the current of the compressors. (Check all three legs if compressors are three phase.)
14. During pulldown, verify that the R-502 (or R12) refrigeration charge is within tolerance. Refer to cooling section for charging checks and to the preventive maintenance section for charging procedures.
* 15. Verify proper compressor oil level in each compressor. With Copeland compressors, the oil level should be maintained at, or slightly above, the center of the sightglass. With Carlyle compressors, the oil level should be between 1/8 and 3/8 up the sightglass. If it is necessary to add oil, use 3G refrigeration grade oil.
16. If refrigeration gauges are not included with your chamber, put a good set of calibrated gauges on each system.
17. With cooling still ON, select a setpoint on the applicable instrumentation that will run the temperature above +100°F (+37.8°C). This will cause the system to operate in the bypass mode. Verify the correct bypass valve setting per the refrigeration schematic.
18. Verify that each refrigeration pressure switch or valve and each temperature switch is at the proper setting. The proper settings can be found on the refrigeration schematic.
19. With water cooled systems, verify that the inlet water temperature is at the proper level per the refrigeration schematic.
20. Select the lowest setpoint within the range of the testing system (per the data summary sheet in the manual) on the applicable instrumentation. Verify that the system will pull down and control at this low temperature.
21. Set up the applicable instrumentation for a high-low program, or a manually operated cycle, according to specifications the testing system will meet. Verify that the system will carry out this program or cycle. DO NOT yet install the product to be tested.

    NOTE: Steps 22 - 26 apply only to testing systems with non pressurized vapor generator type humidity systems.

22. Verify that the wet sock is on the wet bulb sensor and that it is in the wick tank.

* Not applicable to hermetically sealed compressors.

INSTALLATION INSTRUCTIONS

START UP PROCEDURE:

"System on" Procedure: (Continued)

23. Open the water valves for the humidity system. Verify that the wick tank and humidity generator fill with water. Verify also that the drain valves for the humidity generator and wick tank are closed.
24. Select a high humidity condition on the applicable instrumentation.
25. Turn the HUMIDITY SYSTEM switch ON.
26. With an amprobe, check humidity heater current. (Check all three legs if heater is three phase.)
27. Operate the system at the maximum conditions for which the system is designed, per the data summary sheet in the manual. Verify that the chamber will meet all of the necessary conditions. These conditions will include some or all of the following: high temperature, low temperature, high humidity, low humidity. DO NOT install the product to be tested for this procedure.

HUMIDIFICATION/DEHUMIDIFICATION

DRY AIR PURGE:

If your chamber is equipped with a dry air purge mechanism, note the following information. The dry air purge will supply a constant flow of dry air to the chamber to prevent condensation and other moisture related problems. The dry air purge is operated by a MANUAL/OFF/AUTOMATIC switch located on the console and two switches located on the purge assembly. It is recommended that the switches on the purge assembly be left ON at all times. The MANUAL/OFF/AUTOMATIC switch energizes the purge control circuit directly with the switch in the MANUAL position. When the switch is in the AUTOMATIC position, the purge control circuit is energized through an auxiliary event relay.

NOTE: The dry air purge mechanism is a desiccant drying system. The air supply must be oil-free, as even small amounts of oil will destroy the drying capabilities of the desiccant.

ELECTRICAL

ELECTRICAL SCHEMATIC SYMBOLS:

Disconnect Switch

Fuse

Heat Link

Heater

Chamber Interior Light

Panel Function Light

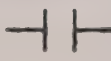
Energizing Coil (Contactor, Timer, Relay, etc.)

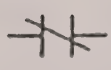
ON Delay Timer Contact (Timed to close)

ON Delay Timer Contact (Timed to open)

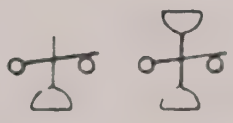
OFF Delay Timer Contact (Timed to close)

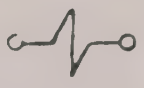
OFF Delay Timer Contact (Timed to open)


Normally Open Contact

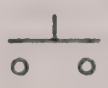

Normally Closed Contact

Thermal Actuated Switch (Heat & Cooling Limits, etc.


Pressure Actuated Switch


Refrigeration Solenoid

Switch


Pushbutton Switch

PROTECTIVE AND/OR SAFETY DEVICES

All Thermotron chambers include some of the following devices. Refer to the appropriate drawings/parts lists within this manual to assist in determing which protective and/or safety devices are incorporated into your specific chamber.

NOTE: When working with any of the following devices which can be manually reset, do not reset more than twice in succession; the source of the tripping must be located.

DUAL FUNCTION HIGH/LOW PRESSURE SWITCH:

Typical settings:	Open High Range	275 P.S.I.G.
	Open Low Range	5" Hg. or 0 P.S.I.G.

Refer to the refrigeration schematic. Dual function high/low pressure switches are labeled H/LPS, and are shown above the associated compressor. Also note the switch settings on the refrigeration schematic.

The high side of this switch is piped to sense the pressure of the discharge side of the refrigeration compressor, set to interrupt the control circuit of the compressor at abnormal pressure. The low side of this switch is piped to sense the pressure of the suction side of the refrigeration compressor and to interrupt the compressor control circuit at abnormal pressure. (Manual Reset).

HIGH PRESSURE SWITCH:

Typical setting: 350 P.S.I.G.

Refer to the refrigeration schematic. High pressure switches are labeled HPS and are shown above the associated compressor. Also note the switch setting on the refrigeration schematic. The most common application of this switch is in the R-502 circuit on systems equipped with a remote air cooled condenser.

PROTECTIVE AND/OR SAFETY DEVICES

HIGH PRESSURE SWITCH (continued)

This switch is piped to sense the pressure of the discharge side of the refrigeration compressor. It is set to interrupt the control circuit of the compressor at abnormal pressure. (Manual Reset).

LOW PRESSURE SWITCH:

Refer to refrigeration schematic for setting.

Refer to the refrigeration schematic. Low pressure switches are labeled LPS, and are shown above the associated compressor. Also note the switch setting on the refrigeration schematic. The most common application of this switch is in the R-502 circuit on systems equipped with a remote air cooled condenser.

This switch is piped to sense the pressure of the suction side of the refrigeration compressor. It is set to interrupt the control circuit of the compressor if the pressure remains below tolerance after a timed delay. (Manual Reset).

OIL PRESSURE SWITCH:

Setting with Carlyle compressors: Opens with 5 P.S,I.G. difference
Setting with Copeland compressors: Opens with 9 P.S.I.G. difference

Refer to the refrigeration schematic. Oil pressure switches are labeled OPS, and are shown to the left of the associated compressor.

This switch is located to sense the oil pressure and suction pressure of the compressor. It is designed to open the control circuit of the compressor at a set difference, to protect the compressor against oil pressure failure. (Manual Reset).

PROTECTIVE AND/OR SAFETY DEVICES

PUMP DOWN PRESSURE SWITCH:

Typical settings: Closes at 30 P.S.I.G.
Opens at 10 P.S.I.G.

Refer to the refrigeration schematic. Pump down pressure switches are labeled PDPS, and are shown above and to the left of the associated compressor. Also note the switch settings on the refrigeration schematic. A common application of pump down pressure switches is within single stage refrigeration systems.

This switch prevents excessive refrigerant migration into the suction side of the compressor by energizing the compressor when the suction pressure rises to set limits. (Automatic Reset)

HIGH PRESSURE DUMP VALVE:

Opens at 235 P.S.I.G.

Refer to the refrigeration schematic. This valve, which is included only in cascade refrigeration systems, is shown above and to the right of the R-13 high/low pressure switch.

This valve is located adjacent to the R-13 vapor tank and its function is to prevent the high pressure of the low stage refrigeration system from rising above a set level. When the pressure exceeds this value, the valve opens and relieves this pressure to the vapor tank. The vapor is returned to the suction side of the compressor through the return line. This "dumping" process will continue until the pressure is no longer above tolerance. (Auto Reset).

PROTECTIVE AND/OR SAFETY DEVICES

COMPRESSOR DISCHARGE THERMOSTAT:

Set at +240°F (+116°C)

Refer to the refrigeration schematic. Compressor discharge thermostats are labeled TS, and are shown to the right and slightly above the associated compressor.

This thermostat is factory adjusted to interrupt the control circuit of the compressor if the discharge gas temperature exceeds set limit. This will occur only at abnormal conditions. (Manually Reset)

RELIEF VALVE:

Typically relieves at 320 P.S.I.G. or 450 P.S.I.G.

Refer to the refrigeration parts list and refrigeration schematic, and locate the relief valves on the schematic, using the find numbers provided. Refer to the actual relief valve to confirm the pressure at which it relieves.

Refief valves are located in the high pressure piping of the refrigeration system to protect the system against excessive pressure. Refrigerant is expelled from the system when the pressure exceeds the relief valve limits.

COMPRESSOR CRANKCASE HEATER:

Refer to the refrigeration parts list and the refrigeration schematic, and locate the crankcase heater, if your system is equipped with one. On the refrigeration schematic, the crankcase heater is shown to the right of the associated compressor, (never R-13) and is labeled HTR. Also refer to the electrical schematic and note the crankcase heater

PROTECTIVE AND/OR SAFETY DEVICES

COMPRESSOR CRANKCASE HEATER (continued)

When applicable, the crankcase heater is located in the bottom of the refrigeration compressor crankcase to prevent any liquid refrigerant from collecting in the oil.

ALTITUDE/HEAT INTERLOCK (altitude chambers only)

Typically Opens at approximately 10,000 feet (523 TORR)

Refer to the electrical schematic. If your testing system is equipped with an altitude/heat interlock, there will be a pressure switch labeled LVPS, in the heating circuit. Also verify the TORR setting on the electrical schematic. (The TORR setting may be converted to feet of altitude by means of the altitude pressure table included in this manual.)

This pressure switch is designed to provide reduced heater wattage above a set altitude.

ALTITUDE/TEMPERATURE INTERLOCK (altitude chambers only)

Typically opens at approximately 65,000 feet (43 TORR)

Refer to the electrical schematic. If your system is equipped with an altitude/temperature interlock, there will be a pressure switch labeled HVPS preceding the heating and/or cooling control circuitry. Also verify the TORR setting on the electrical schematic. (The TORR setting may be converted to feet of altitude by means of the altitude pressure table included in this manual.)

This pressure switch is designed to open the heating and/or cooling control circuitry above a set altitude.

PROTECTIVE AND/OR SAFETY DEVICES

DOOR LIMIT SWITCH:

Refer to the electrical schematic. Door limit switches are typically shown in the control circuitry, and are labeled LS. When a system is equipped with a door limit switch, the door(s) must be closed in order to operate portions of the testing system.

DOOR HOIST LIMIT SWITCHES:

Only chambers with one or more vertical lift doors are equipped with door hoist limit switches. Refer to the hoist circuitry on the electrical schematic. Door hoist limit switches are typically labeled LS. When the door is clamped into position, the corresponding door limit switch opens, thereby preventing the door hoist control circuit from being energized.

LOW LIMIT SWITCH:

Low limit switches are most commonly present in testing systems which have an LN_2 or CO_2 cooling system. Refer to the electrical schematic, specifically the LN_2 or CO_2 circuitry. Low limit switches are typically labeled LLS.

Low limit switches are wired to open the corresponding cooling control circuit in the event the testing system falls below the lowest designed temperature. (adjustable, normally auto reset)

HEAT LIMIT SWITCH:

Most testing systems are equipped with a heat limit switch. Refer to the electrical schematic. Heat limit switches are shown in the control circuit, and are labeled HLS.

PROTECTIVE AND/OR SAFETY DEVICES

HEAT LIMIT SWITCH (continued)

The heat limit switch is wired in series with the heating control circuit to open the circuit in the event the testing system exceeds the highest designed temperature. (Adjustable, normally manual* reset

* When the hot compartment heat limit on thermal shock chambers is built into the hot compartment controller, it is automatic reset type.

HUMIDITY HEAT LIMIT SWITCH:

Typically opens at +116°C (+240°F)

Only chambers with vapor generator type humidification systems are equipped with a humidity heat limit switch. Refer to the humidification circuitry on the electrical schematic. Within this circuitry, locate the humidity heat limit switch(es)which will be labeled HLS.

This switch is located on the humidity vapor generator, and is wired in series with the humidity heating control circuit to open the circuit to protect the vapor generator from exceeding designed temperature limits. (Adjustable; Manual Reset)

HIGH HEAT THERMOSTAT:

Typically opens at +85°C (+185°F)

High heat thermostats are found only in walk-in chambers, although not all walk-in chambers are equipped with them. Refer to the chamber lights circuitry on the electrical schematic. If included with your chamber, the high heat thermostat will be shown within this circuitry, and will be labeled HLS.

When the chamber temperature rises to set limits, this thermostat opens, thereby disabling the chamber lights. (Manual Reset)

PROTECTIVE AND/OR SAFETY DEVICES

CONDENSATE HEAT THERMOSTAT:

Typically opens at +15.6°C (+60°F)

Condensate heat thermostats are found only in walk-in chambers. Most walk-in chambers are equipped with one. Refer to the door heater circuit on the electrical schematic. Within this circuitry, locate the condensate heat thermostat, which will typically be labeled THT.

When the chamber temperature rises to set limits, the condensate heat thermostat causes all condensate heaters to be disabled. (Adjustable, auto reset)

HEAT LINKS:

Most testing systems are equipped with heat links. To verify that your system has heat links, refer to the heater wiring portion of the electrical schematic. Heat links will be found in this portion of the schematic, and will be labeled HL. Refer also to the electrical parts list and find symbol HL, which stands for heat link. Note the item number corresponding to symbol HL. If the item number is 534010, the heat links on your chamber fuse at +238°C (+460°F). If the item number is 534037, the heat links fuse at +107°C (+225°F).

Heat links are located on the heaters, and are wired in series with the heater to open the circuit in the event the testing system exceeds designed temperature limits. This control will fuse open when the heater frame temperature reaches set limits. (Not Resettable; Replace)

PROTECTIVE AND/OR SAFETY DEVICES

FAN CONTROL PRESSURE SWITCH:

Only chambers with a remote air cooled condenser are equipped with fan control pressure switches. However, not all chambers with remote air cooled condensers are equipped with them. Refer to the remote condenser circuitry on the electrical schematic. If included with your system, the fan control pressure switches will be shown within this circuitry, and will typically be labeled FCPS.

The fan control pressure switch(es) prevent(s) the remote air cooled condenser(s) from being energized when the head pressure is not within set limits.

REMOTE CONDENSER THERMOSTATS:

Only chambers with a remote air cooled condenser are equipped with remote condenser thermostats. However, not all chambers with a remote air-cooled condenser have remote condenser thermostats. Refer to the remote condenser circuitry on the electrical schematic. If included with your system, the remote condenser thermostat will be shown within this circuitry, and will typically be labeled THT.

These thermostats energize and de-energize the remote air cooled condenser motors, depending on the outside air temperature. (At lower temperatures, fewer motors are energized.)

PROTECTIVE AND/OR SAFETY DEVICES

MALFUNCTION RELAY:

If there is a refrigeration reset pushbutton and indicator light on the electrical panel door, your system is equipped with a malfunction relay.

The malfunction relay is a holding relay that monitors all of the refrigeration safety control in the circuit. Upon an out of tolerance condition on any of the refrigeration equipment safety devices, this relay is de-energized, and the complete refrigeration circuit is opened. The malfunction relay is reset by depressing the refrigeration reset pushbutton. (Manual Reset)

MASTER HEAT CONTACTOR:

Most testing systems are equipped with a master heat contactor. Locate the MH contactor within the electrical schematic heating control circuitry to verify that your system has a master heat contactor.

This contactor is wired in series with the heat control contactors. Its function is to provide more positive protection against over-temperature of the testing system.

NOTE: This contactor does not cycle with heat demand. It will cycle on and off with the high temperature limit device(s), thereby providing protection against burned closed contacts.

MASTER HUMIDITY CONTACTOR:

Chambers with vapor generator type humidification systems are normally equipped with a master humidity contactor. Locate the MW contactor within the electrical schematic humidity control circuitry to verify that your system has a master humidity contactor.

PROTECTIVE AND/OR SAFETY DEVICES

MASTER HUMIDITY CONTACTOR (continued)

The function of this contactor is identical to that of the master heat contactor except that it provides over temperature protection for the humidity generator(s).

PHOTOHELIC AIR FLOW SWITCH/GAGE:

Refer to the refrigeration/pneumatic parts list and the refrigeration and/or pneumatic schematic to determine whether or not your system is equipped with a photohelic air flow switch/gage.

This device monitors the air flow and has individually adjustable high and low air flow limits.

GUARDS are provided for all air circulators.

AIR CIRCULATORS must be on before conditioning control circuit can be energized, with the exception of vacuum circuits.

ALL REFRIGERANTS used are non-toxic.

ALL ELECTRICAL CIRCUITS are separately fused.

ALL CONTROL SWITCHES have indicator lights.

ALL MACHINERY is enclosed.

COMPRESSORS, CIRCULATORS, and VACUUM PUMPS are overload protected.

OPERATING INSTRUCTIONS

These operating instructions will tell the operator what must be done to place the chamber in operation. A thorough study of the electrical schematics and operating instructions of each control component must also be made to become proficient in operating this chamber.

TEMPERATURE OPERATION:

1. Turn all the switches to the OFF position.

2. Place the PILOT switch in the ON position.

3. If desired, place the chamber LIGHT switch in the ON position. (Not all chambers will be equipped with this switch.)

4. Prepare the Honeywell Recorder as follows:

   A. Turn the POWER switch, located inside the recorder door, to the ON position.

   B. Install new circular chart.

   C. Rotate chart and chart hub by turning hub until correct time line on chart is opposite time index.

   D. Replace pen(s) on chart.

5. Program the programmer-controller for the required test program to be performed.

OPERATING INSTRUCTIONS

6. Place the CIRCULATOR switch in the ON position.

7. Place the COOL switch in the ON position.

8. If your system is equipped with a REFRIGERATION RESET push button, momentarily depress the push button.

9. If your chamber is equipped with an auxiliary cooling system (CO_2 or LN_2), and if auxiliary cooling is desired; place the AUXILIARY COOL switch in the ON position at the appropriate time and also adjust the auxiliary cool interrupter (located inside the console) for the desired auxiliary cool control.

10. Place the HEAT switch in the ON position.

11. If your chamber is equipped with a dry air purge system, and if purge operation is desired; place the PURGE switch in the desired position.

    NOTE: When the PURGE switch is in the AUTO position, the proper auxiliary event relay must be programmed ON, at the appropriate time, in order to close the purge control circuit.

    If purge operation is desired, the PURGE and DRYER switches, located on the dry air purge assembly, must be in the ON position.

PREVENTIVE MAINTENANCE

GENERAL INFORMATION:

In the day to day operation of this equipment, you will become aware of certain levels of noise, vibration, temperature and pressure. If you encounter any significant changes in these levels, investigate them immediately. You should also develop a preventive maintenance program for this equipment. The preventive maintenance section following will assist you in the construction of this program. While this section is not all inclusive, and will also refer to items not present in your system, it will serve as a good base on which to build your own custom preventive maintenance program. The establishment of such a program will add significantly to the life of the equipment and will establish the unscheduled down time of the equipment at an absolute minimum.

PREVENTIVE MAINTENANCE

GENERAL INFORMATION:

It is necessary that personnel performing maintenance procedures be trained and experienced in the following areas:

1. Basic refrigeration and fundamentals (where applicable).
2. Electrical troubleshooting.
3. Calibration and standards for environmental test equipment.

TOOLS REQUIRED:

Following is a list of basic tools required for maintenance and service.

1. Refrigeration manifold.*
2. Leak detector (electronic type is recommended).*
3. Compressor service valve wrenches.*
4. Amprobe/Voltmeter.
5. Supply of applicable refrigerants.*
6. Calibration equipment.
   - A. Digital voltmeter (3½ digit).
   - B. Millivolt driver/source.
   - C. Decade resistance to 1/100 ohm.

NOTE: The preceding is not an all inclusive list. Additional tools may be required in order to maintain your equipment.

* Not applicable if your chamber is not equipped with a mechanical refrigeration system.

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE - FREON 13 SYSTEM:

When to add: Refrigerant will need to be added when the standby pressure of the system falls approximately 10 P.S.I. below the level recorded on the equipment serial tag.

Material required: 1 set of manifold refrigeration gauges, three charging hoses, one tank of Freon 13.

Note: Freon 13 at ambient temperature is at a pressure exceeding 450 P.S.I. Extreme care should be taken in handling this gas.

Procedure:

1. Connect the charging hoses to the refrigeration gauges.

2. Connect the center charging hose to the Freon 13 tank outlet valve. (Be sure the valve is OFF.)

3. Turn the compressor discharge and suction service valves all the way counter-clockwise; backseating the valves.

4. Connect the suction gauge hose to the compressor suction service valve. Connect the discharge gauge hose to the compressor discharge service valve.

5. Open the hand valves on the gauge manifold and bleed (purge) a small amount of gas through the charging hose.

6. After the hoses are purged, close the Freon 13 tank outlet valve and tighten the hose fittings on the compressor service valves.

7. Turn the compressor suction and discharge service valves clockwise (half turn only). Any charge in the system will be read on the gauges. This charge is referred to as the standby pressure. To read the proper pressure, the chamber and cascade compartment must be at ambient temperature.

8. To add gas, slowly open the outlet valve on the Freon 13 tank, allowing the higher pressure gas in the tank to flow into the refrigeration system; when the gauge reads the pressure indicated on the equipment serial tag, close the outlet valve of the Freon 13 tank.

9. Allow the unit to stand for 15 minutes and recheck the standby. It will probably be necessary to add more gas. Again, open the outlet valve on the Freon 13 tank and raise the standby to the proper level. Close the valve.

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE - FREON 13 SYSTEM: (Continued)

10. Allow the chamber to stand approximately 15 minutes and recheck the standby. This procedure may be followed until the proper standby is reached.

11. After the standby is reached, turn both hand valves on the manifold all the way clockwise. (Frontseat.)

12. With the hand valves in this position, the operating pressures of the system may be read when the equipment is running.

13. If it is desired that the gauges be removed, backseat both compressor service valves (turned all the way counter-clockwise) and remove the charging hoses.

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE - FREON 502 SYSTEM:

NOTE: The following charging procedure applies only to R-502 systems which are equipped with a local condenser.

When to add: Refrigerant will need to be added when bubbles appear in the sightglass; during pulldown after 2 minutes of operation.

Materials required: One set of manifold refrigeration gauges, three charging hoses, one tank of Freon 502.

Procedure:

1. Connect the three charging hoses to refrigeration gauge manifold.
2. Connect the center charging hose to the Freon 502 tank. (Outlet valve of tank must be OFF.)
3. Turn the suction and discharge service valves on the compressor all the way out (backseat).
4. Connect the hose from the suction gauge to the compressor suction service valve. Leave the fitting loose.
5. Connect the hose from the discharge gauge to the compressor discharge service valve. Leaving the fitting loose.
6. Open both hand valves on the refrigeration gauge manifold.
7. Slowly open the outlet valve on the Freon 502 tank and purge the charging hoses.
8. Tighten the hose connections on the compressor suction and discharge service valves.
9. Turn the discharge hand valve on the refrigeration gauge manifold all the way clockwise (frontseat). The suction hand valve should remain open.
10. Turn the compressor suction and discharge service valves clockwise (half turn only). Any charge in the system will be read on the gauges.
11. Start the R-502 compressor and watch for bubbles in the sightglass. This must be checked on the pulldown after a minimum of two minutes of running.

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE - FREON 502 SYSTEM: (Continued)

12. Open the outlet valve on the Freon 502 tank and allow the refrigerant to flow until there are no bubbles in the sightglass.

13. Turn OFF the outlet valve on the Freon 502 tank.

14. Continue to watch the sightglass for bubbles during normal pulldown operation. If bubbles appear, more Freon 502 may have to be added.

    NOTE: If bubbles appear during the bypass operation, this does not indicate a low charge.

15. To use the gauges during compressor operation, both hand valves should be turned all the way in (frontseated).

16. To remove the gauges, turn the compressor suction and discharge service valves all the way counter-clockwise (backseat) and remove the charging hoses.

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE-FREON 502 or 12 REMOTE AIR COOLED:

NOTE: The following applies only to systems which are equipped with a remote air cooled condenser.

Note the liquid receiver tank located under the remote air cooled condenser. Located on the side of this receiver tank will be either two liquid test indicators or a liquid level indication gauge. If your receiver tank has liquid test indicators, refer to the following charging procedures.

When to add: Refrigerant will need to be added when the liquid refrigerant charge is lower than the proper level at the liquid test indicators on the receiver. (Refer to step 12 for details).

Materials required: One set of manifold refrigeration gauges, three charging hoses. one tank of Freon 502 or 12, as applicable.

PROCEDURE:

1. Connect the three charging hoses to refrigeration gauge manifold.
2. Connect the center charging hose to the Freon tank. (Outlet valve of tank must be OFF.)
3. Turn the suction and discharge service valves for the compressor all the way out (backseat).
4. Connect the hose from the discharge gauge to the compressor discharge service valve. Leave the fitting loose.
5. Connect the hose from the discharge gauge to the compressor discharge service valve. Leave the fitting loose.
6. Open both hand valves on the refrigeration gauge manifold.
7. Slowly open the outlet valve on the Freon tank and purge the charging hoses.
8. Tighten the hose connections on the compressor suction and discharge service valves.
9. Turn the discharge hand valve on the refrigeration gauge manifold all the way clockwise (frontseat). The suction hand valve should remain open.
10. Turn the compressor suction and discharge service valves clockwise (half turn, only). Any charge in the system will be read on the gauges.

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE (continued):

11. Before checking the charge, start the compressor, and make sure that the sightglass is clear of bubbles.

12. When the sightglass is clear, the charge must be checked at the liquid receiver tank under the condenser. Locate the two liquid test indicators located on the side of the receiver. During summer operation (+50°F and above), the liquid refrigerant charge should reach the top liquid test indicator. During winter operation (+50°F and below), the liquid refrigerant charge should reach only to the bottom liquid test indicator.

    NOTE: Refer also to the charging tab on the tank between the two liquid test indicators.

13. If additional charge is necessary, open the outlet valve on the Freon tank and allow the refrigerant to flow until the liquid refrigerant charge reaches the proper liquid test indicator for the existing temperature condition.

14. Turn OFF the outlet valve on the Freon tank.

15. During normal pulldown operation, continue to observe the level of the liquid refrigerant charge at the liquid test indicators. If the level goes down, more refrigerant may have to be added.

16. To use the gauges during compressor operation, both hand valves should be turned all the way in (frontseated).

17. To remove the gauges, turn the compressor suction and discharge service valves all the way counter-clockwise (backseat) and remove the charging hoses.

If your receiver tank has a liquid level indication gauge, refer to the following charging procedures:

When to add: Refrigerant will need to be added when the liquid refrigerant charge is lower than the proper level as indicated on the liquid level indication gauge on the receiver. (Refer to step 12 for details.)

Materials required: One set of manifold refrigeration gauges, three charging hoses, one tank of Freon 502 or Freon 12, as applicable.

PROCEDURE:

1. Connect the three charging hoses to refrigeration gauge manifold.

2. Connect the center charging hose to the Freon tank. (Outlet valve of tank must be OFF.)

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE (continued)

3. Turn the suction and discharge service valves for the compressor all the way out (backseat).

4. Connect the hose from the suction gauge to the compressor suction service valve. Leave the fitting loose.

5. Connect the hose from the discharge gauge to the compressor discharge service valve. Leave the fitting loose.

6. Open both hand valves on the refrigeration gauge manifold.

7. Slowly open the outlet valve on the Freon tank and purge the charging hoses.

8. Tighten the hose connections on the compressor suction and discharge service valves.

9. Turn the discharge hand valve on the refrigeration gauge manifold all the way clockwise (front seat). The suction hand valve should remain open.

10. Turn the compressor suction and discharge service valves clockwise (half turn, only). Any charge in the system will be read on the gauges.

11. Before checking the charge, start the compressor, and make sure that the sightglass is clear of bubbles.

12. When the sightglass is clear, the charge must be checked at the liquid receiver tank under the condenser. Note the liquid level indication gauge on the side of the receiver tank. During summer operation (+50°F and above), the charge is within tolerance when the gauge reads approximately 60%. During winter operation (+50°F and below), the charge is within tolerance when the gauge reads approximately 30%.

13. If additional charge is necessary, open the outlet valve on the Freon tank and allow the refrigerant to flow until the liquid level indication gauge indicates the proper charge for the existing temperature condition.

14. Turn OFF the outlet valve on the Freon tank.

15. During normal pulldown operation, continue to observe the reading on the liquid level indication gauge. If the reading goes down, more refrigerant may have to be added.

16. To use the refrigeration gauges during compressor operation, both hand valves should be turned all the way in (frontseated).

17. To remove the refrigeration gauges, turn the compressor suction and discharge service valves all the way counter-clockwise (backseat) and remove the charging hoses.

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE - FREON 12 SYSTEM: (with local condenser)

When to add: Refrigerant will need to be added when bubbles appear in the sightglass; during pulldown after at least two (2) minutes of operation.

Materials required: One set of manifold refrigeration gauges, three charging hoses and one tank of Freon 12.

Procedure:

1. Connect the three charging hoses to refrigeration gauge manifold.
2. Connect the center charging hose to the Freon 12 tank. (Outlet valve of tank must be OFF.)
3. Turn the suction and discharge service valves on the compressor all the way out (backseat).
4. Connect the hose from the suction gauge to the compressor suction service valve. Leave the fitting loose.
5. Connect the hose from the discharge gauge to the compressor discharge service valve. Leave the fitting loose.
6. Open both hand valves on the refrigeration gauge manifold.
7. Slowly open the outlet valve on the Freon 12 tank and purge the charging hoses.
8. Tighten the hose connections on the compressor suction and discharge service valves.
9. Turn the discharge hand valve on the refrigeration gauge manifold all the way clockwise (frontseat). The suction hand valve should remain open.
10. Turn the compressor suction and discharge service valves clockwise (half turn, only). Any charge in the system will be read on the gauges.
11. Start the R-12 compressor and watch for bubbles in the sightglass. This must be checked on the pulldown after a minimum of two minutes of running.
12. Open the outlet valve on the Freon 12 tank and allow the refrigerant to flow until there are no bubbles in the sightglass

PREVENTIVE MAINTENANCE

CHARGING PROCEDURE - FREON 12 SYSTEM: (Continued)

13. Turn OFF the outlet valve on the Freon 12 tank.

14. Continue to watch the sightglass for bubbles during normal pulldown operation. If bubbles appear, more Freon 12 may have to be added.

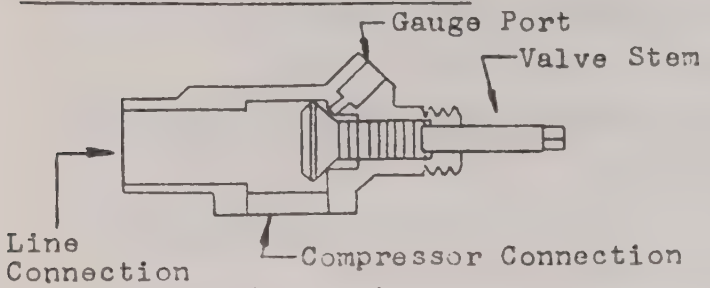
    NOTE: If bubbles appear during the bypass operation, this does not indicate a low charge.

15. To use the gauges during compressor operation, both hand valves should be turned all the way in (frontseated).

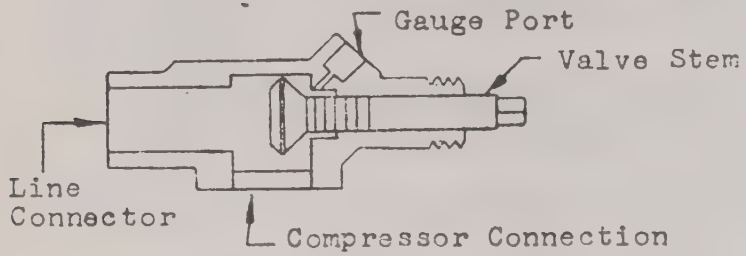
16. To remove the gauges, turn the compressor suction and discharge service valves all the way counterclockwise (backseat) and remove the charging hoses.

PREVENTIVE MAINTENANCE

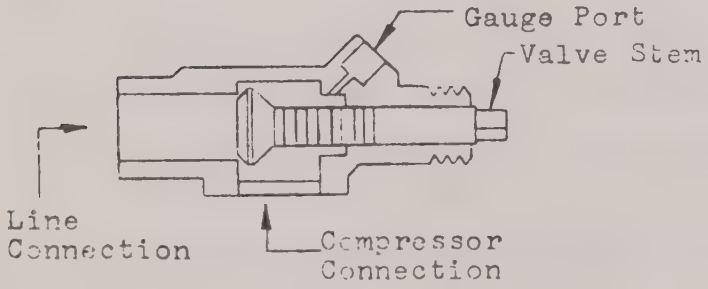
COMPRESSOR SERVICE VALVES:



(Fig. 1)



(Fig. 2)



(Fig. 3)

TERMINOLOGY

Purge - Blowing out gas for the purpose of removing noncondensables.

Frontseat - To cause the valve to seat against the front valve seat, as in Fig. 3.

Backseat - To cause the valve to seat against the back valve seat, as in Fig. 1.

Charge - The amount of refrigerant in a system; to put in the refrigerant charge.

Bypass - The refrigerant is directed through a bypass circuit instead of the cooling coils. This is in effect a no cooling condition.

Heat-Up - That condition where the temperature goes from a lower to a higher level.

Pull-Down - That condition where the temperature goes from a higher level to a lower level.

PREVENTIVE MAINTENANCE

VALVE ADJUSTMENTS:

When expansion valve or service valve stem adjustment is required, proceed as follows:

1. Remove stem cap. (Service cap)
* 2. Loosen packing gland.
3. Adjust stem as necessary.
* 4. Tighten packing gland.
5. Snug stem cap (service cap) with a wrench.
6. Leak check.

* For expansion valves, a special tool is required for loosening and tightening packing glands. Contact Thermotron Parts Department if you need this tool.

NOTE: FAILURE TO FOLLOW THE PRECEDING INSTRUCTIONS WILL GREATLY INCREASE CHANCES OF PACKING GLAND RELATED LEAKS.

MISCELLANEOUS CHECKS:

Periodically perform the following checks when applicable to your equipment:

1. Examine compressor mountings for loose or broken springs.
2. Check compressor head fans for loose or broken fan hubs.
3. Examine and inspect door seals for rips, cracks, and deteriorated silicon rubber.

PREVENTIVE MAINTENANCE

CAUTION 1:

Make certain that the upper refrigeration enclosure panels maintain a moisture seal. Failure to properly seal the panels might result in leakage of water onto the test unit site, and could result in saturation of insulation, thereby reducing cooling efficiency.

CAUTION 2:

In systems which are equipped with a pump-down pressure switch, it is often possible for a refrigeration compressor and other components to be energized through the pump-down pressure switch, even when the PILOT switch is OFF. Therefore, exercise the necessary caution when performing maintenance or service procedures. (Refer to the electrical schematic.)

SUGGESTED PREVENTIVE MAINTENANCE INTERVALS:

	Inspect	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Annually	See Description #
1	Vacuum Pump	X						1
2	R-502 or R-12 Charge		X					2
3	R-13 Stand-by Charge		X					3
4	* Compressor Oil Level		X					4
5	Blower Belts & Pulleys			X				5
6	Circulator Motor			X				6
7	Humidity System ** (Wet Bulb Type)			X				7
8	Electrical Panel			X				8
9	Operating Currents			X				9
0	Oil Pressure				X			10
1	Condenser (Air Cooled)				X			11
2	Tubing Abrasion			X		X		12
3	Condenser (Water-Cooled)						X	13
4	Desuperheater (Water-Cooled)						X	14
5	Air Over Oil Tank-Oil Level				X			15

* Not applicable to hermetically sealed compressors.

** When applicable, refer to the humidification section in this manual for further preventive maintenance procedures relevant to the humidity system.

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE ROUTINE DESCRIPTIONS:

1. Vacuum Pump:

   The oil level should be checked each day the vacuum pump will be run. Other checks such as belt tension, RPM, oil cleanliness and others will have to be performed on an "as required" basis, depending on how much the vacuum pump is used.

2. R-502 or R-12 Charge:

   With Local Condenser:

   Observe the sightglass to see if there are any bubbles. This should be checked during pulldown after at least 2 minutes of operation. Bubbles indicate a lack of refrigerant. If bubbles are seen during bypass operation, this does not indicate a gas shortage.

   With Remote Air-Cooled Condenser:

   Make sure that the sightglass is clear of bubbles. When the sightglass is clear, the charge must be checked at the liquid receiver tank under the condenser. This receiver has two liquid test indicators located on its side. During summer operation (+50°F or above), the liquid refrigerant charge should reach the top liquid test indicator. During winter operation (+50°F or below), the liquid refrigerant charge should reach only to the bottom liquid test indicator.

   NOTE: For either type of system observe the color of the moisture indicator in the sightglass. Green is dry; yellow-green (chartreuse) is a caution; and yellow indicates moisture.

3. R-13 Standby Charge:

   If gauges are permanently attached, the standby may be read on the R-13 discharge gauge prior to the day's operation if the equipment has been turned OFF overnight. If the equipment has been running, the chamber (and cascade section) must be at ambient temperature, and equalized in order to read the stand-by pressure. The factory stand-by pressure is recorded on the serial tag. The gauge reading should be approximately that of the standby pressure recorded on the serial tag.

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE ROUTINE DESCRIPTIONS: (Continued)

4. Compressor Oil Level:

With Copeland Compressors:

The oil level should be maintained at, or slightly above the center of the sightglass. Oil leakage should not be tolerated. Any deviation from the normal oil level should be investigated immediately.

With Carlyle Compressors:

Make sure that the oil level is maintained between 1/8 and 3/8 up the sightglass. Also see Carlyle refrigeration Compressor Service Guide specifications. Oil leakage should not be tolerated. Any deviation from the normal oil level should be investigated immediately.

5. Blower Belts and Pulleys:

Check the blower pulleys for rough surfaces or edges that could wear the belt. Also, check for tightness on the motor shaft. Check the belt for wear and tension.

6. Circulator Motors:

Check the rotation of the fan. Rotation is normally correct when maximum discharge is over the instrument control sensor. Check the fan for tightness on the motor shaft.

On altitude chambers an additional check must be made to see that the oil level is maintained in the oil cups on the motor. Maintain approximately 1/2 inch of oil in the lower cup. Use maximum of 30 weight motor oil; minimum of 10 weight motor oil.

7. Humidity Systems: (Wet Bulb Type)

Check to see if the dew probe sensor is still accurate. Sample the condition of the air by using a reference cell such as a sling psychrometer. If shut down time is a problem, it is wise to purchase a second dew probe sensor to replace the one in use. This provides for a standby sensor as well as a means to spotcheck the condition of the operating sensor. In addition, rejuvenation kits can also be purchased to retreat sensors out of operation.

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE ROUTINE DESCRIPTIONS: (Continued)

Check to see if the wet bulb sock is collecting any deposits from the water. This should be changed periodically depending on the water conditions. Also, make a visual inspection of the humidity system, checking for water deposits and leaks.

8. Electrical Panel:

Check for components and wires that may vibrate loose during operation. Check for sign of contactor or relay arcing. Verify that the power and ground connections are secure.

9. Operating Currents:

With an amprobe, check the operating current of the compressors, heaters, circulators, and other components. These values are shown on the electrical schematic.

10. Oil Pressure:

The oil pressure should run from 15 to 50 P.S.I.G. above the suction pressure of the compressor. A reading below 15 P.S.I.G. should be investigated immediately.

11. Air Cooled Condenser:

The air-cooled condenser should be cleaned quarterly. This period may be extended if operating conditions warrant it.

12. Tubing Abrasion:

Check for evidence of friction wear on all refrigeration lines. Particular care should be taken on inspecting capillary tubes to pressure switches and gauges. This check should be made each time the refrigeration machinery panels are removed.

13. Water Cooled Condenser:

Annually check the condenser for buildup of scale on the condensing surface. This interval may need to be shortened if the buildup is of a substantial amount.

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE ROUTINE DESCRIPTIONS: (Continued)

14. Water Cooled Desuperheater:

The desuperheater should be descaled at the same interval as the water cooled condenser.

15. Air Over Oil Tank-Oil Level: (Thermal Shock Chambers only)

When the piston is fully extended, the fluid should be to the top of the sightglass. Maintain oil at this level, using 3G refrigeration grade oil if it is necessary to add oil.

PREVENTIVE MAINTENANCE

EXTENDED POWER OUTAGE:

If your refrigeration system is equipped with a crankcase heater it is necessary to allow a warm up time before operating the compressor after an extended main power outage. As long as main power is on, the crankcase heater prevents liquid refrigerant from condensing in the compressor crankcase. If the main power is interrupted for a sufficient time, the refrigerant will condense in the crankcase, and because it is miscible, it will mix with the oil. If the compressor is started in this condition, the refrigerant boils violently and carries the oil with it through the compressor. This causes an oil shortage in the compressor crankcase, which will shorten bearing life and may cause the oil differential switch to open.

The easiest way to determine the amount of warm up time necessary is to feel the bottom of the applicable compressor crankcase. If the crankcase is warm, there will not be condensed liquid. If it is at ambient or cooler the crankcase heater must be given time to warm the crankcase and boil off any refrigerant.

TROUBLESHOOTING

GENERAL INFORMATION:

The following troubleshooting section is not all inclusive, and will refer to items not present in your system. But it will serve as a good base on which to build a troubleshooting plan for your specific system.

It is necessary that personnel performing troubleshooting procedures be trained and experienced in the following areas:

1. Basic refrigeration and fundamentals. (When applicable)
2. Electrical troubleshooting.
3. Calibration and standards for environmental test equipment.

Troubleshooting of environmental test equipment can be divided into four major steps:

1. Determine the trouble symptoms.
2. Localize the trouble to a functional unit.
3. Isolate the trouble to a circuit.
4. Locate the specific trouble, probably to a specific part.

TOOLS REQUIRED:

Following is a list of basic tools required for troubleshooting and service.

1. Refrigeration manifold.*
2. Leak detector (electronic type is recommended).*
3. Compressor service valve wrenches.*
4. Amprobe/Voltmeter.
5. Supply of applicable refrigerants.*

* Not applicable if your chamber is not equipped with a mechanical refrigeration system.

TROUBLESHOOTING

TOOLS REQUIRED: (Continued)

6. Calibration equipment:
   A. Digital voltmeter (3 1/2 digit).
   B. Millivolt driver/source.
   C. Decade resistance to 1/100 ohm.

NOTE: The preceding is not an all inclusive list. Additional tools may be required in order to maintain your equipment.

TROUBLESHOOTING

CAUTION:

In systems which are equipped with a pump-down pressure switch, it is often possible for a refrigeration compressor and other components to be energized through the pump-down pressure switch, even when the PILOT switch is OFF. Therefore, exercise the necessary caution when performing troubleshooting and service procedures.

TROUBLESHOOTING

	Symptoms		Causes		Remedy
A.	Compressor does not run.	1.	Main power disengaged.	1.	Close main power disconnect or equipment disconnect switch.
		2.	Fuse blown.	2.	Replace fuse.
		3.	Contacts on compressor contactor inoperative.	3.	Repair.
		4.	Refrigeration reset circuit open.	4.	Refer to symptom M.
		5.	Compressor seized.	5.	If the compressor has caused the inherent overloads to trip, allow time for the compressor to cool and the inherent overloads to reset. Change one phase of the compressor power to reverse compressor rotation. Restart the compressor. If compressor will not start, notify the factory for further assistance.
		6.	Contactor control circuit open.	6.	Check for open control circuit.
B.	Unit short cycles continuously.	1.	Instrument control differential set too closely.	1.	Widen differential.
		2.	Time-out circuit set too low.	2.	Increase "Time-out" time.
C.	Compressor will not start - hums intermittently. (Cycling on overload.)	1.	Improperly wired.	1.	Check wiring against diagram.
		2.	Low line voltage.	2.	Check main line voltage - determine location of voltage drop.

TROUBLESHOOTING

Symptoms	Causes	Remedy
C. (Continued)	*3. Open starting capacitor.	3. Replace starting capacitor.
	4. Open contactor contact.	4. Make physical inspection of contacts or substitute a new contactor.
	5. Open circuit in starting winding.	5. Make a continuity check of the starting winding.
	6. Stator winding grounded.	6. Make a continuity check from the stator winding to ground.
	7. High discharge pressure.	7. Check for refrigerant overcharge or noncondensables.
	8. Tight compressor.	8. Check oil level - correct binding.
D. Compressor starts, motor will not get off starting winding.	1. Low line voltage.	1. Bring up voltage.
	2. Improperly wired.	2. Check wiring against diagram.
	3. Defective start - run relay.	3. Check operation manually; replace relay if defective.
	*4. Running capacitor.	4. Check by disconnecting running capacitor.
	5. Starting and running windings shorted.	5. Check resistances. Replace stator if defective.
	6. Starting and running windings shorted.	6. Check capacitance. Replace if low.
	7. High discharge pressure.	7. Check for refrigerant overcharge or noncondensables.
	8. Tight compressor.	8. Check oil level. Check binding.

* 1 H.P. units and under.

TROUBLESHOOTING

Symptoms	Causes	Remedy
E. Start Run Relay burn out.	1. Low line voltage.	1. Increase voltage to not less than 10% under compressor motor rating.
	2. Excessive line voltage.	2. Reduce voltage to maximum of 10% over motor rating.
	* 3. Incorrect running capacitor.	3. Replace running capacitor with correct mfd. capacitance.
	4. Short cycling.	4. Reduce number starts per hour. (See symptom B.)
	5. Incorrect mounting.	5. Mount relay in correct position.
	6. Incorrect relay.	6. Use relay properly selected for motor characteristics.
	7. Relay vibrating.	7. Mount relay in rigid location.
F. Insufficient cooling effect.	1. Refrigerant shortage.	1. Repair leak and recharge.
	2. Frosted coil.	2. Defrost and dry coil.
	3. Low air circulation.	3. Check fan rotation.
	4. Compressor inefficient.	4. Check for tightness or defective valves.
	5. Cooling coils or capillary tube obstructed.	5. Remove obstruction.
G. R-13 Head Pressure too high.	1. Refrigerant overcharge.	1. Purge.
	2. Air in system.	2. Purge.
	3. R-502 system short of gas.	3. Repair leak and recharge.

* 1 H.P. units and under.

TROUBLESHOOTING

Symptoms	Causes	Remedy
H. R-13 Head Pressure too low.	1. Refrigerant shortage.	1. Repair leak and recharge.
	2. Compressor suction or discharge valves inefficient.	2. Clean or replace leaky valve plates.
I. R-502 or R-12 Head Pressure too high.	1. Condensing water (air) too warm.	1. Supply cooling water (air).
	2. Restricted water (air) cooled condenser.	2. Clean or replace condenser.
	3. Water valve too far closed.	3. Adjust water valve for proper head pressure.
	4. Air in system.	4. Purge.
J. R-502 or R-12 Head Pressure too low.	1. Condensing water (air) too cold.	1. Adjust water valve for proper head pressure, or increase condensing air temperature.
K. Noisy unit.	1. Insufficient compressor oil.	1. Add oil to proper level. (See symptom L, Remedy 2.)
	2. Tubing rattle.	2. Bend tubes away from contact.
	3. Mountings loose.	3. Tighten.
	4. Oil slugging or refrigerant flooding back.	4. Correct cause of floodback.
L. Compressor loses oil.	1. Shortage of refrigerant.	1. Repair leak and recharge.
	2. Machinery section remote or system change made.	2. With Copeland compressors, add oil until the oil level is at or slightly above the center of the sight-glass. With Carlyle

TROUBLESHOOTING

Symptoms	Causes	Remedy
L. (Continued)		compressors, add oil until the oil level is between 1/8 and 3/8 up the sightglass. Refer also to Carlyle refrigeration Compressor Service Guide. (Use 3G refrigeration grade oil.)
	3. Short Cycling.	3. Refer to symptom B.
	4. Superheat too high at compressor suction.	4. Change location of expansion valve bulb or adjust valve to return wet gas to compressor.
M. Refrigeration reset light ON.	1. Nuisance tripping due to line fluctuation.	1. Check line with a voltmeter or recorder.

NOTE: Refer to the refrigeration malfunction circuit pages in this manual for further causes and remedies relating to symptom "M".

TROUBLESHOOTING

REFRIGERATION MALFUNCTION CIRCUIT:

Most Thermotron refrigeration systems are equipped with refrigeration equipment safety devices. These safety devices are normally incorporated into one of two primary types of malfunction circuits.

Malfunction Circuit Type 1:

Malfunction circuit type #1 consists of a magnetically latched malfunction* relay and the associated safety devices. These safety devices are wired in series with the malfunction relay so that interruption of any single safety device will de-energize the malfunction relay which, in turn, disengages the control power to the compressor contactors. This type of system also has a refrigeration reset pushbutton (a momentary contact switch normally located on the electrical compartment door), that energizes the malfunction relay through the refrigeration safety circuit. Once initially reset, the malfunction relay is magnetically latched until one of the refrigeration safety devices or a main power interruption opens the circuit. One or more "refrigeration trip" indicator lights will be energized in the event of a main power interruption or a refrigeration malfunction. When this occurs, the first step should be to depress the reset pushbutton. If the system does not restart immediately, the safety devices should be checked, to determine which device has tripped and the cause of its tripping.

* Some chambers are equipped with two malfunction relays.

TROUBLESHOOTING

REFRIGERATION MALFUNCTION CIRCUIT: (Continued)

Malfunction Circuit Type 2:

Malfunction circuit type 2 is not equipped with a malfunction relay. In this case, each of the refrigeration equipment safety devices are wired to directly interrupt the control power to the compressor(s) upon the applicable out of tolerance condition. When one of the safety devices has interrupted the circuit, the safety devices should be checked to determine which device has tripped, and the cause of its tripping.

TROUBLESHOOTING

REFRIGERATION MALFUNCTION CIRCUIT:

When a refrigeration safety device has tripped, and interrupted the compressor control circuit, it is very important to locate and correct the source of the tripping. Continuous resetting to complete a test or portion of a program cycle could cause damage to the refrigeration system.

> CAUTION
>
> EQUIPMENT MAY BE DAMAGED
>
> AND WARRANTY VOID BY
>
> IMPROPER RESETTING

REFRIGERATION SAFETY DEVICE TROUBLESHOOTING:

Occasionally, Thermotron systems are equipped with indicator lights to aid in determining which safety device has tripped. Most often, however, a series of checks must be made to determine the source of the trip. Refer to the following for assistance in determining: which device has tripped, the cause of the trip, and how to correct the out of tolerance condition. Your specific system may not include all of the safety devices detailed in the following troubleshooting instructions.

TROUBLESHOOTING

COMPRESSOR OVERLOAD PROTECTION MODULES:

If your system is equipped with either one or two Copeland compressors and a malfunction relay, it will also be equipped with compressor overload protection module contact(s) in the malfunction circuit. When trying to determine which safety device has tripped, it is recommended that the troubleshooting begin with the overload protection modules, when applicable to your system. Depending on how severe an overload has occurred, the overload modules may require up to 10-15 minutes to automatically reset. To check the overload modules, depress the refrigeration reset pushbutton after an adequate delay. If the refrigeration system restarts, an overload module contact was open, and the cause for its opening must be determined. Check the three phase current of each of the compressors. Excessive current on any one leg would indicate a possible cause for an overload. Refer to the Copeland Electrical Handbook for further information.

TROUBLESHOOTING

OIL PRESSURE DIFFERENTIAL SWITCHES:

Cascade systems are normally equipped with two oil pressure differential switches while single stage systems have one. To check each oil pressure differential switch, perform the following: Manually reset the oil pressure differential switch. If your system has a malfunction relay, depress the refrigeration reset pushbutton. If the refrigeration system restarts, the oil pressure differential switch was open, and the cause of its opening must be determined. Check the oil level of the associated compressor. If it is a Copeland compressor, the oil level should be at, or slightly above, the center of the sightglass. If it is a Carlyle compressor, the oil level should be between 1/8 and 3/8 up the sightglass. If the oil level is out of tolerance, add oil as necessary, using 3G refrigeration grade oil. If the oil pressure differential switch has tripped and the associated compressor oil level is within tolerance, contact a factory representative for assistance.

R-13 High-Low Pressure Switches:

The R-13 portion of the cascade system is normally equipped with a high-low pressure switch. To check the R-13 high-low pressure switch, perform the following: Manually reset the R-13 high-low pressure switch. If your system has a malfunction relay, depress the refrigeration reset pushbutton. If the refrigeration system restarts, the R-13 high-low pressure switch was open, and the cause for its opening must be determined. By watching the high and low pressure gauges during operation, it can be determined

TROUBLESHOOTING

R-13 High-Low Pressure Switches: (Continued)

whether the high or the low pressure side of this switch is exceeding its limits. If it appears that the low pressure side of the switch is opening, determine the R-13 standby pressure. If this pressure is 10 P.S.I. or more below the pressure recorded on the serial tag, refrigerant must be added until the recorded standby pressure is reached. If pressure readings indicate that the high pressure side of the switch is opening, perform the following: A) Check the R-13 standby pressure, and purge refrigerant from the system if there is an overcharge. B) Check the R-502 sightglass for a refrigerant shortage, and add R-502 as necessary. C) Check for air or non-condensables in system, and purge as necessary.

TROUBLESHOOTING

R-502, R-12 HIGH and LOW PRESSURE SWITCHES:

The R-502 portion of the cascade system is normally equipped with either a high-low pressure switch or separate high and low pressure switches. Single stage R-502 or R-12 systems are also normally equipped with either a high-low pressure switch or separate high and low pressure switches.

A. R-502 or R-12 High-Low Pressure Switches.

To check the high-low pressure switch, perform the following: Manually reset the high-low pressure switch. If your system has a malfunction relay, depress the refrigeration reset pushbutton. If the refrigeration system restarts, the high-low pressure switch was open, and the cause for its opening must be determined. By watching the high and low pressure gauges during operation, it can be determined whether the high or the low pressure side of the switch is exceeding its limits. If pressure readings indicate that the low pressure side of the switch is opening, check the sightglass for a refrigerant shortage and add refrigerant as necessary. If pressure readings indicate that the high pressure side of the switch is opening, perform the following: 1) If the system is water cooled, check for high temperatures in the refrigeration system water supply, and supply cooler water, as necessary. If the system is air cooled, check for high condensing air temperatures, and reduce temperature, as necessary. 2) If the system

TROUBLESHOOTING

R-502, R-12 HIGH and LOW PRESSURE SWITCHES: (Continued)

is water cooled, check the water regulating valve, to see if it may be closed too far, and adjust as necessary to coincide with valve setting shown on refrigeration schematic. 3) If the system is air cooled, check the air cooled condenser for cleanliness, particularly in the coil face area, and clean as necessary. 4) Check for air or non-condensables in system, and purge as necessary.

B. R-502 or R-12 Low Pressure Switch. (When there are separate high and low pressure switches.)

To check the low pressure switch, perform the following: Manually reset the low pressure switch. If your system has a malfunction relay, depress the refrigeration reset push-button. If the refrigeration system restarts, the low pressure switch was open, and the cause for its opening must be determined. Check the refrigerant charge. If the refrigerant charge is low, add refrigerant as necessary.

C. R-502 or R-12 High Pressure Switch. (When there are separate high and low pressure switches.)

To check the high pressure switch, perform the following: Manually reset the high pressure switch. If your system has a malfunction relay, depress the refrigeration reset push-button. If the refrigeration system restarts, the high pressure switch was open, and the cause for its opening must be determined. If the high pressure switch opens, perform the following

R-502, R-12 HIGH and LOW PRESSURE SWITCHES: (Continued)

1) If the system is water cooled, check for high temperatures in the refrigeration system water supply, and supply cooler water, as necessary. If the system is air cooled, check for high condensing air temperatures, and reduce temperature, as necessary. 2) If the system is water cooled, check the water regulating valve, to see if it may be closed too far, and adjust as necessary to coincide with the valve setting shown on the refrigeration schematic. 3) If the system is air cooled, check the air cooled condenser for cleanliness, particularly in the coil face area, and clean as necessary. 4) Check for air or non-condensables in system, and purge as necessary.

TROUBLESHOOTING

COMPRESSOR DISCHARGE GAS TEMPERATURE LIMITS:

Systems which have malfunction relays are often equipped with compressor discharge gas temperature limits. Discharge temperature limits require approximately 2-3 minutes before being manually reset. To check each discharge temperature limit, perform the following. After waiting 2-3 minutes, manually reset the applicable discharge temperature limit. Depress the refrigeration reset pushbutton. If the refrigeration system restarts, this device was open, and the cause for its opening must be determined.

If it has been determined that the R-13 discharge temperature limit was open, check to see if the R-13 injection valve is feeding properly. Repair or replace if it is not feeding properly. If the injection valve appears to be okay, check the R-13 bypass pressure. (This is the back pressure read on the R-13 suction guage when the system is in bypass operation.) There should be approximately 10 pounds of pressure. Adjust the bypass valve as necessary. If the system continues to open on the R-13 discharge temperature limit, contact a factory representative for assistance.

If it has been determined that the R-502 or R-12 discharge temperature limit was open, check for a shortage of refrigerant. Add R-502 or R-12 as necessary. If the system continues to open on the R-502 or R-12 discharge temperature limit, contact a factory representative for assistance.

R-502 or R-12 CHARGE: (with remote, air cooled condenser, Cont.) charge should reach the top liquid test indicator. During winter operation (+50°F and below), the liquid refrigerant charge should reach only to the bottom liquid test indicator. Refer also to the charging tab on the tank between the two liquid test indicators.

NOTE: Refer to the "CHARGING PROCEDURES" in this manual if it is necessary to add refrigerant.

TROUBLESHOOTING

R-13 CHARGE:

The R-13 system of the Thermotron cascade unit is charged by the "standby" method. The factory R-13 standby pressure is recorded on the equipment serial tag. This will allow a comparison to the present R-13 standby pressure in the system.

To read the R-13 standby pressure properly, two requirements must be met. First, the entire R-13 system (including the cascade) must be at or near ambient temperature. (70°F or 21°C.) Secondly, the R-13 system must be equalized. After the system has equalized, the standby pressure may be read on the R-13 discharge pressure gauge. If the gauge reading is approximately that of the recorded standby pressure, the system should meet the design requirements.

R-502 or R-12 CHARGE: (with local condenser)

A sightglass is used to check the charge. To check the charge, watch the sightglass for bubbles during the pulldown. (The system should run a minimum of two minutes before checking for bubbles.) Bubbles indicate a low charge.

R-502 or R-12 CHARGE: (with remote, air cooled condenser)

Before checking the charge, the sightglass must be clear of bubbles. When the sightglass is clear, the charge must be checked at the liquid receiver tank under the condenser. This receiver has two liquid test indicators located on its side. During summer operation (+50°F and above), the liquid refrigerant

SPARE PARTS

Thermotron recommends that its customers maintain a minimum quantity of spare parts. These parts are essential to the proper care and maintenance of your equipment, which minimize costly down time. We strive to maintain an adequate parts inventory and will be pleased to serve you if we can. Thermotron recommends that parts which fall into the following classifications be retained as spares.

- Bulbs, Lights, Lamps
- ** Circulator Motors
- ** Compressors
- * Contactors
- Demineralizer Cartridges
- Expansion Valves
- Fan Blades
- * Filter Driers
- * Fuses
- Heaters
- * Heat Links
- Injection Valves
- Limit Switches
- Pressure Switches
- Pushbutton Switches
- Relays
- Selector Switches
- Sensors
- * Solenoids
- Thermocouples
- Thermostats
- Time Delay Relays
- Toggle Switches

* High usage parts, which are strongly recommended as spares.
** Low usage parts which would require longer lead times than most.

Refer to the parts lists included in this manual to determine which specific parts are included in your system. Also refer to the parts lists for parts identification numbers.

RETURN OF MATERIALS

In the event that you have a part that has failed under warranty or a part which requires repair, call the Parts and Logistics Department at Thermotron. At this point an R.M.T. (Returned Material Tag) number will be issued, and authorization for the return of the item will be given to you. This number should be marked boldly on the outside of your package as well as recorded on your packing slip. When ordering the replacement part, the following information is required.

A. The complete part number.

B. The serial number of the corresponding Thermotron test unit.

C. The specific complaint regarding part failure.

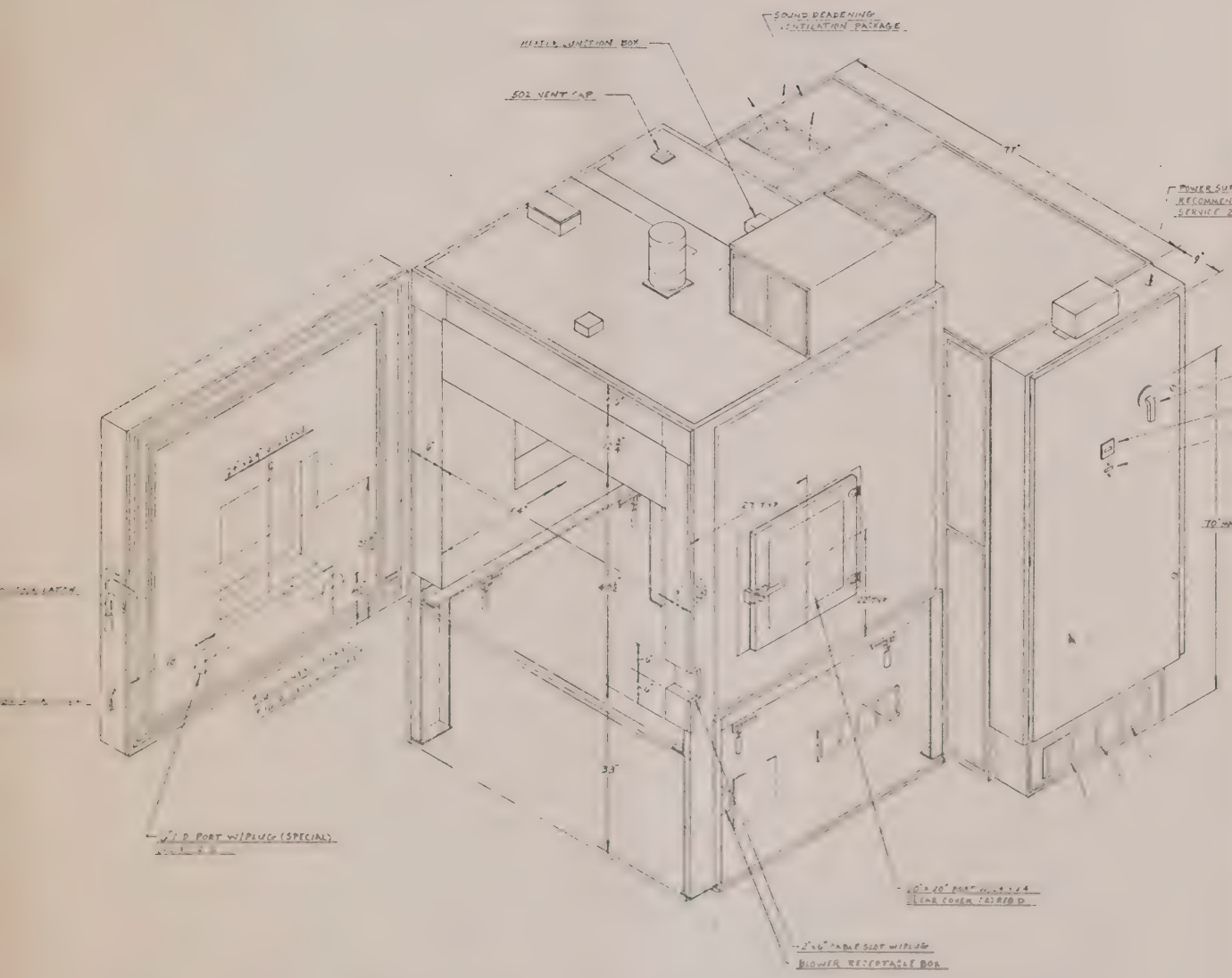
D. A Purchase Order number is preferred, and in many cases required.

A telephone number and contact person should be listed on your packing slip so that we know who to contact in case of a question.

For warranty replacement parts, you will be invoiced upon the date of shipment and will be issued credit on that invoice upon our receipt of the defective item. IT IS IMPORTANT THAT YOU IDENTIFY THE ITEM WITH THE R.M.T. NUMBER THAT IS ASSIGNED.

All parts are shipped F.O.B Holland, MI.

Parts and Logistics Department
Phone: (616) 392-1491
Night Phone: (616) 392-1498



INTAKE DUCT
REQUIRES 20' 6 FLEX X PLUG BLOWER ASSY
(2) 20' SECTIONS OF 12" INSULATED FLEX DUCT

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Thermotron Industries, Inc. Holland MI 49423 U.S.A.

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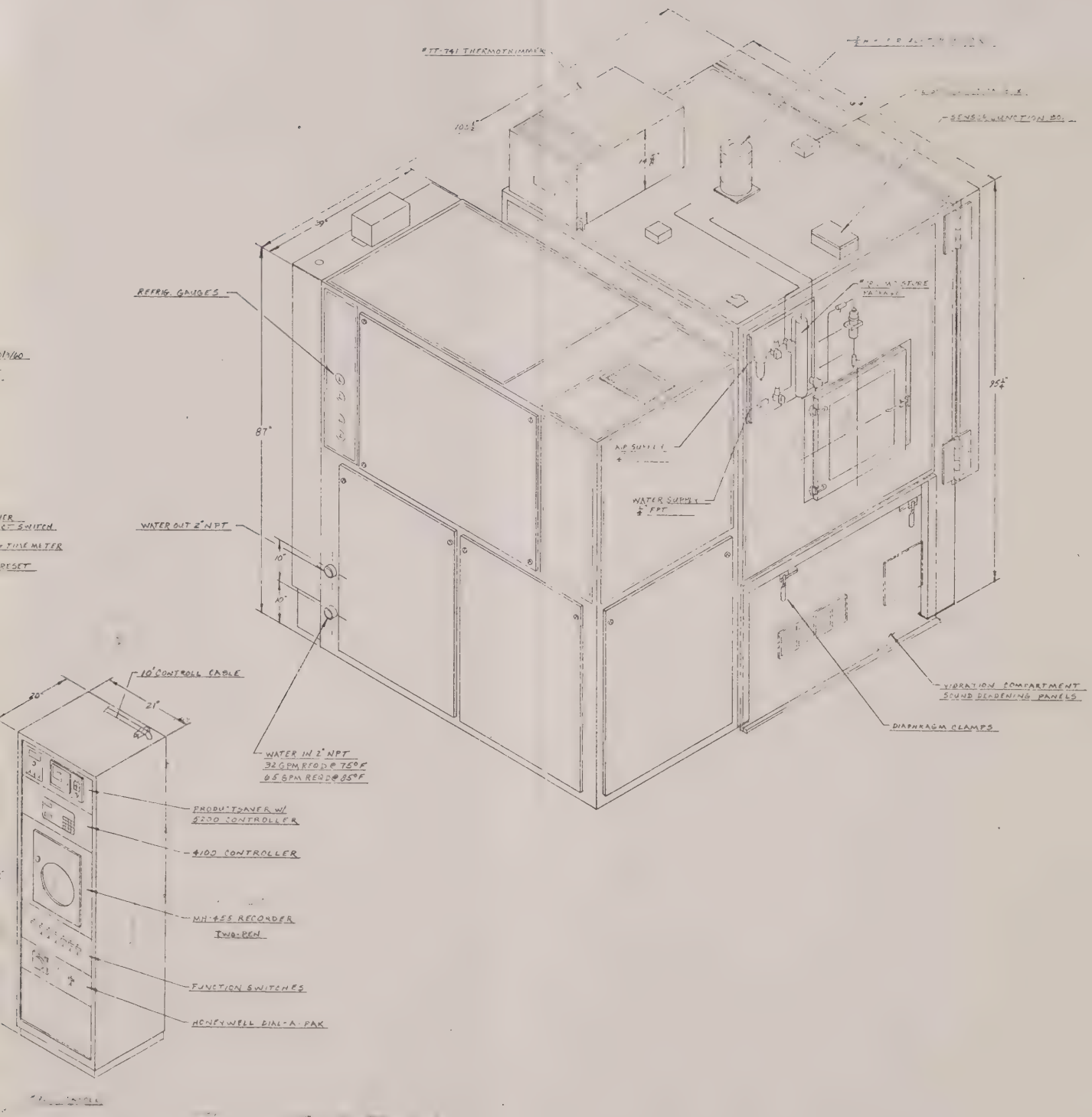

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THERMOTRON

ES, INC., HOLLAND, MICHIGAN 49423 U.S.A.

NO.	CHANGES	DATE	BY	CHK'D	NO.	CHANGES	DATE	BY	CHK'D

TOLERANCE

SCALE

MATERIAL

FINISH

DESCRIPTION

F-74-CNV-30-10 ASSEMBLY

DRAWN BY

DATE 11/1/-

CHECKED BY

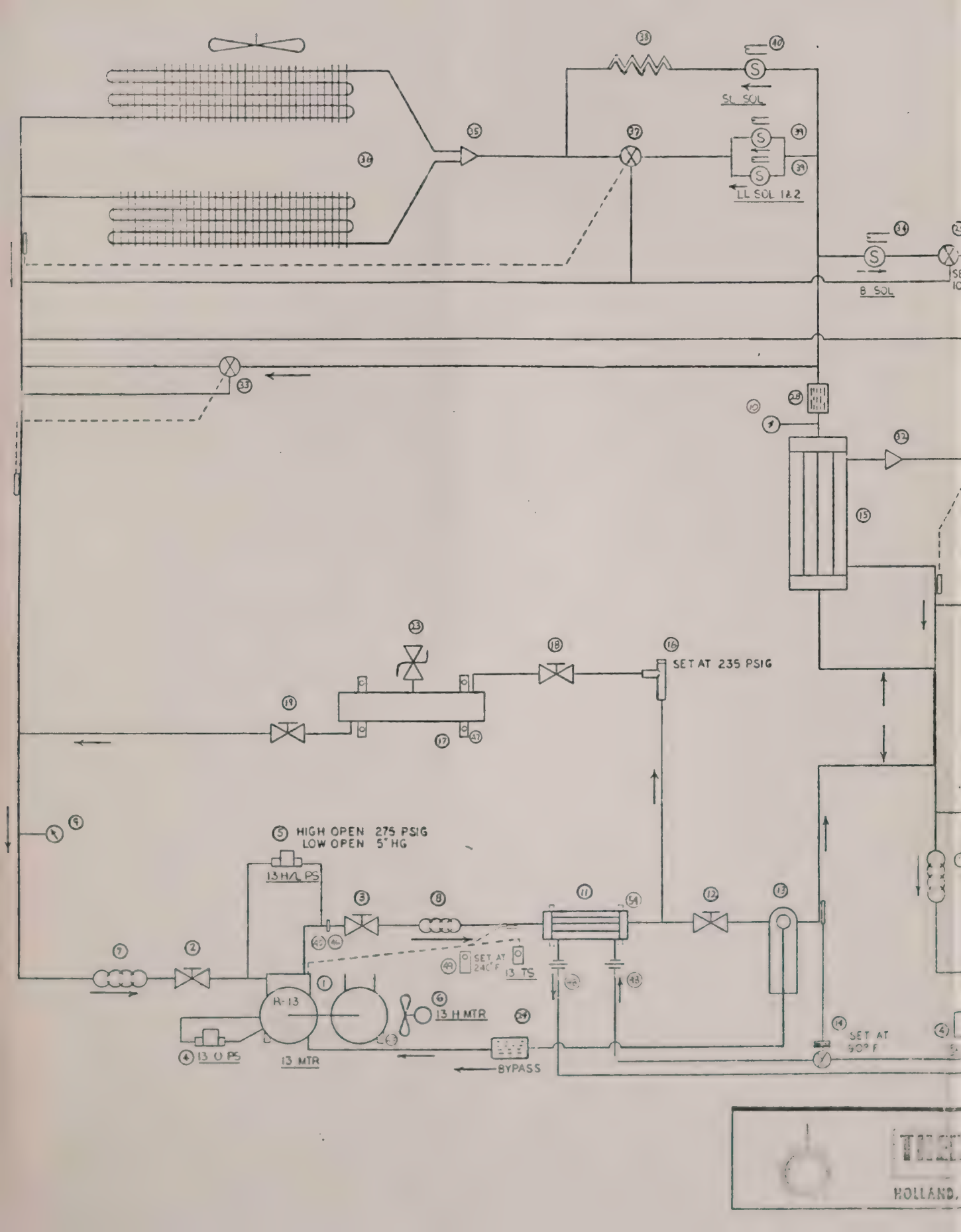
DATE

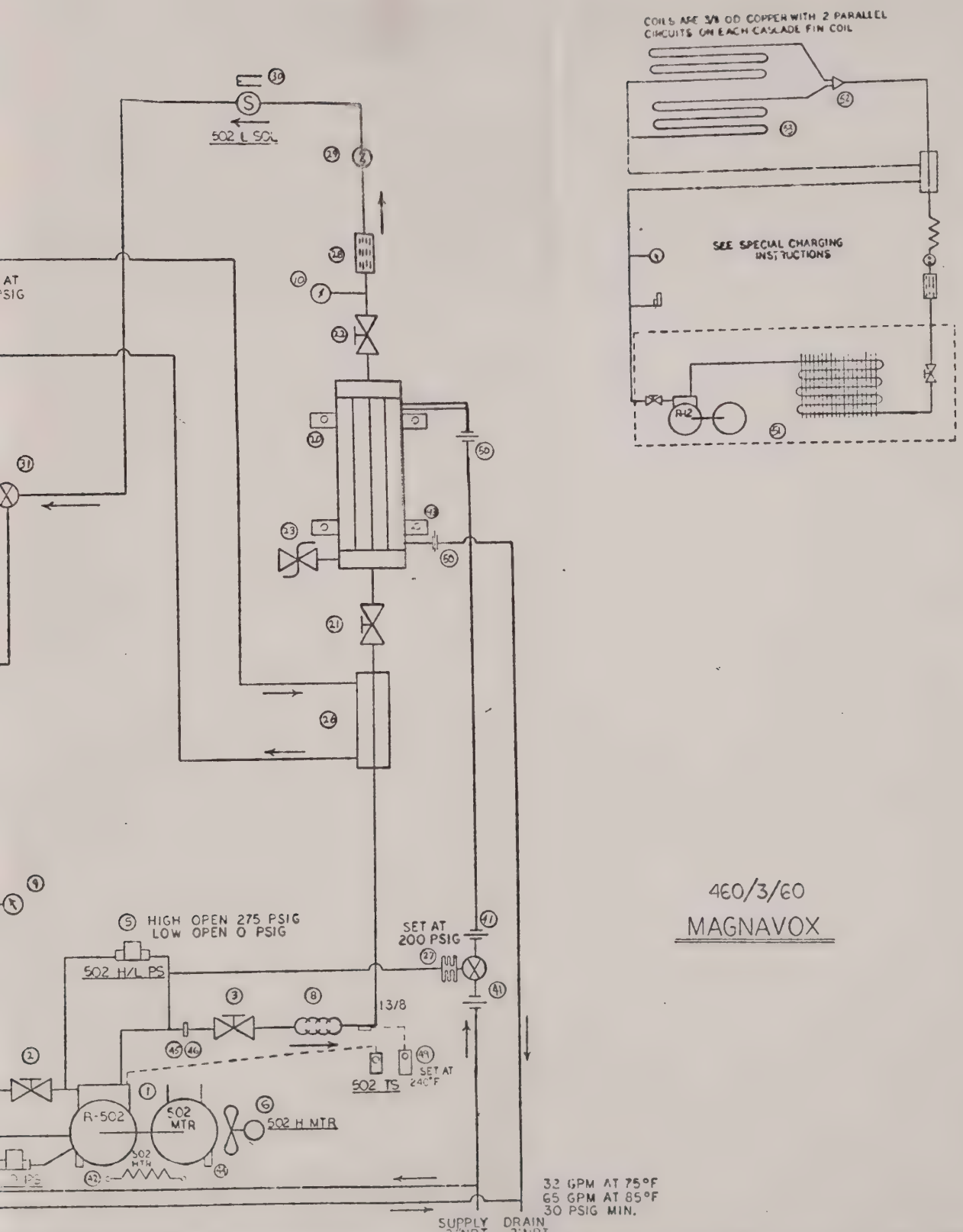
RELEASED BY

DATE

DRAWING NO

SIZE W


SL SOL
LL SOL 1&2
B SOL
SET AT 235 PSIG
⑤ HIGH OPEN 275 PSIG
LOW OPEN 5" HG
13 H/L PS
SET AT 240° F
13 TS
R-13
13 H MTR
④ 13 O PS
13 MTR
BYPASS
SET AT 90° F
HOLLAND



460/3/60

MAGNAVOX

NO	CHANGES	DATE	BY	CH'K'D	NO	CHANGES	DATE	BY	CH'K'D

TOLERANCE

SCALE

MATERIAL

FINISH

DRAWN BY SEAN SCOTT DATE

CHECKED BY DATE

RELEASED BY DATE

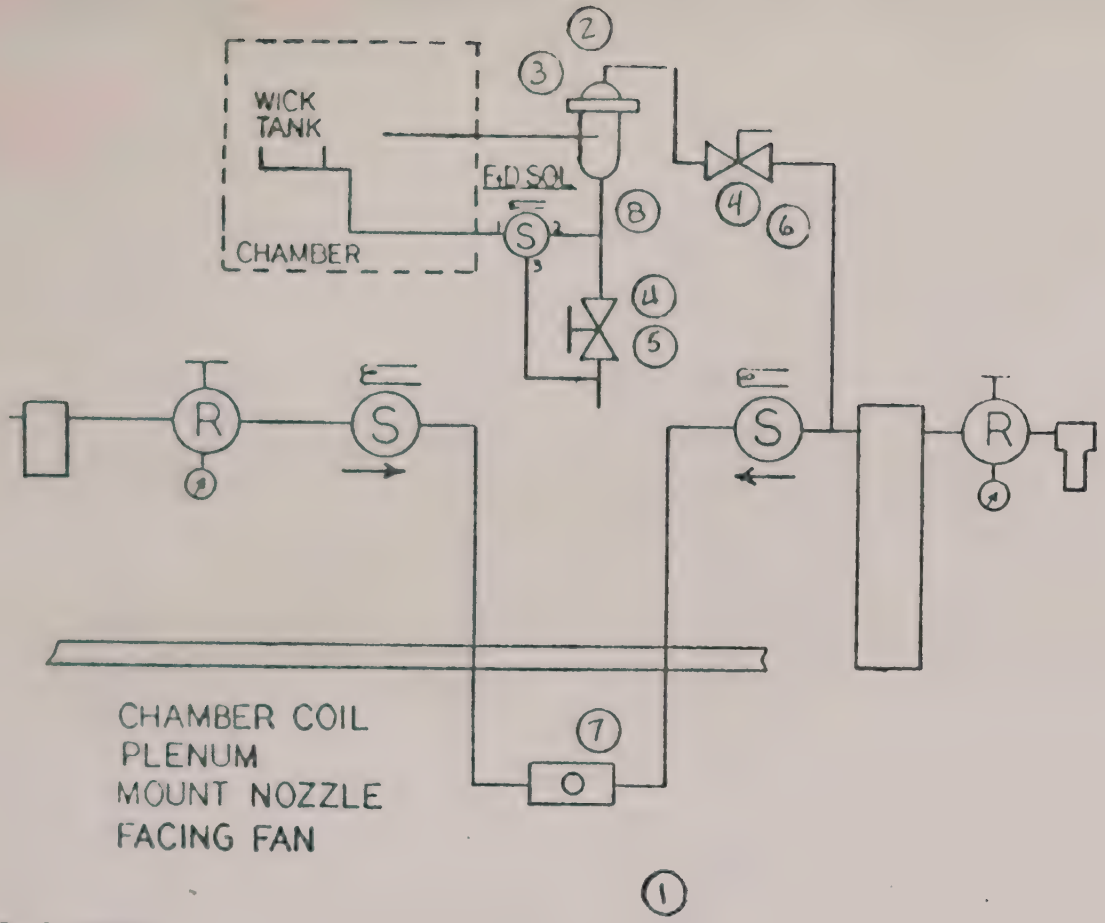
DESCRIPTION

F-74-CHV-30-30

DRAWING NO. 12433-30 W

CORPORATION

MICHIGAN 49423



CHAMBER COIL
PLENUM
MOUNT NOZZLE
FACING FAN

AIR SUPPLY
1/4 NPT

WATER SUPPLY
1/4 NPT
MAX. REGULATOR
SETTING OF
25 PSIG
WATER LINES MUS
HAVE GRAVITY DRAI
W/OUT TRAPS
BETWEEN SOLENO
AND NOZZLE

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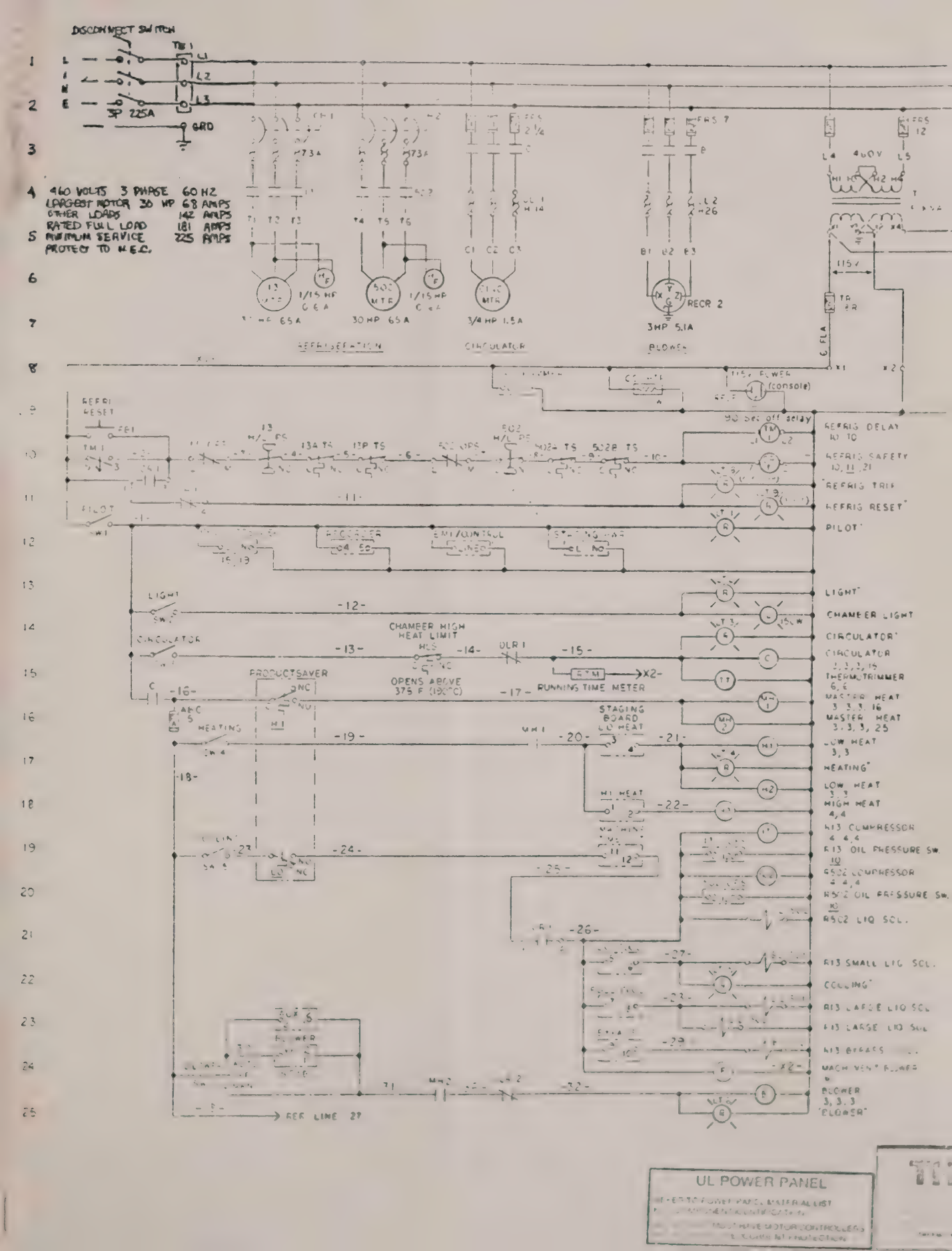
Thermotron Industries, Inc., Holland, Michigan 49423 U.S.A.

DESCRIPTION 781-C
MOISTURE INJECTION

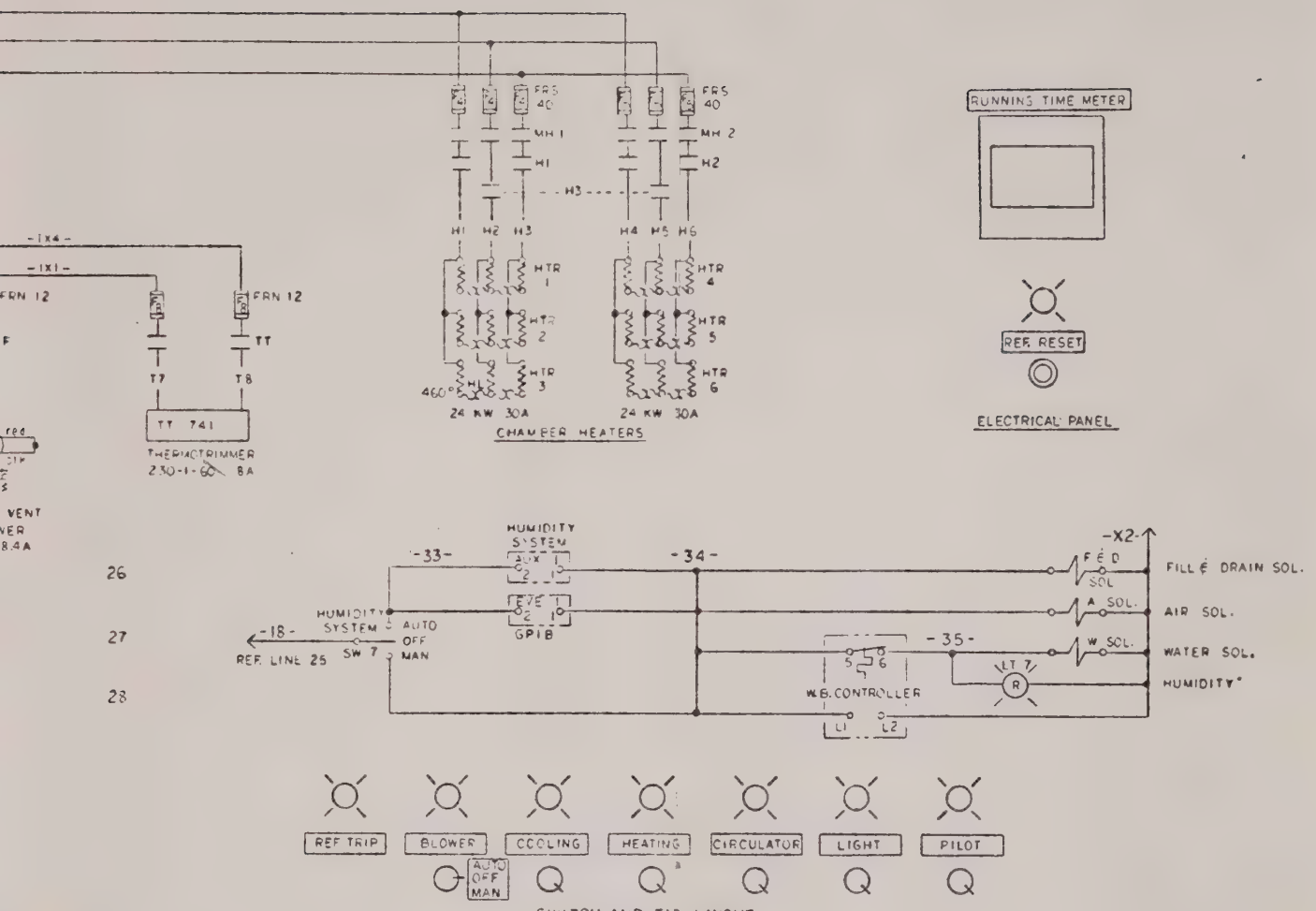
MATERIAL

SYM	DATE	CHANGE	BY
A			
B			
C			
D			

DRAWN BY	DATE	SCALE	APPROV.	FOR	DRAWING NO.	SIZE
K. Belert	3/4/85				H-12433-35	Z



UL POWER PANEL



ELECTRICAL PANEL TERMINALS TB2

(2)5,(4)X2 F1, T7, T8,(2)X1, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 25, (2)26, 27, 28, 29, 31, 32, 34, 35, 36 +4 SPARES

CONSOLE TERMINALS TB 3

(4)3,(5)X2, (2)X1, (3)1, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 +4 SPARES

INTERCONNECT ELECTRICAL PANEL /CONSOLE

10 FT. OF 1 IN. SEALTITE

1 #14	THHN	GREEN	GRD
1 #14	THHN	WHITE	X2
25 #14	THHN	RED	X1, 1, 11, 12, 13, 15, 16, 17, 19, 20, 21, 22, 25, 26, 27, 28, 29, 31, 32, 34, 35

+4 SPARES

NOTES

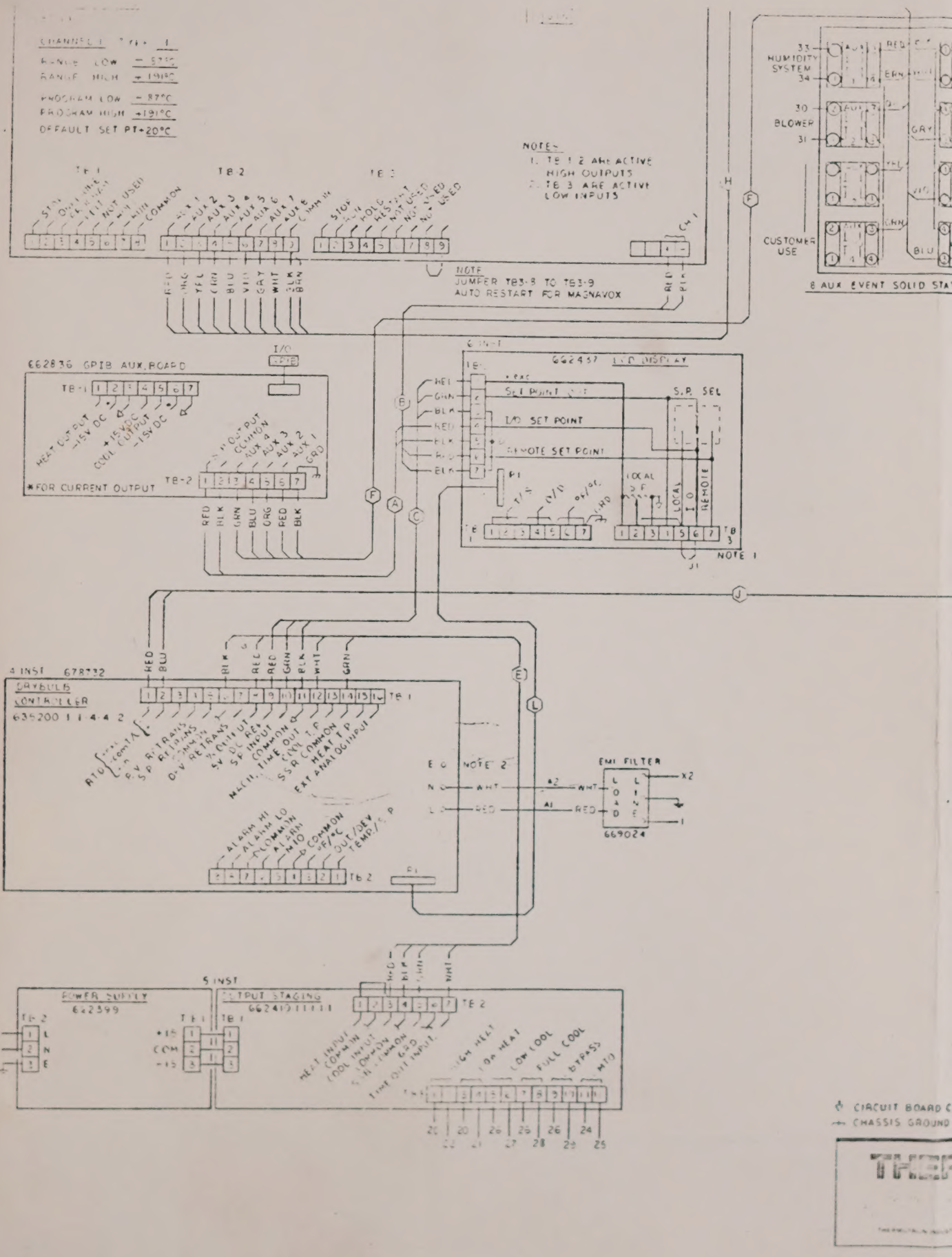
1. FOR INSTRUMENT WIRING SEE DWG. E-12433-2(W)
2. LAST WIRE NUMBER USED: 35
3. WIRE NUMBER(S) NOT USED: ____

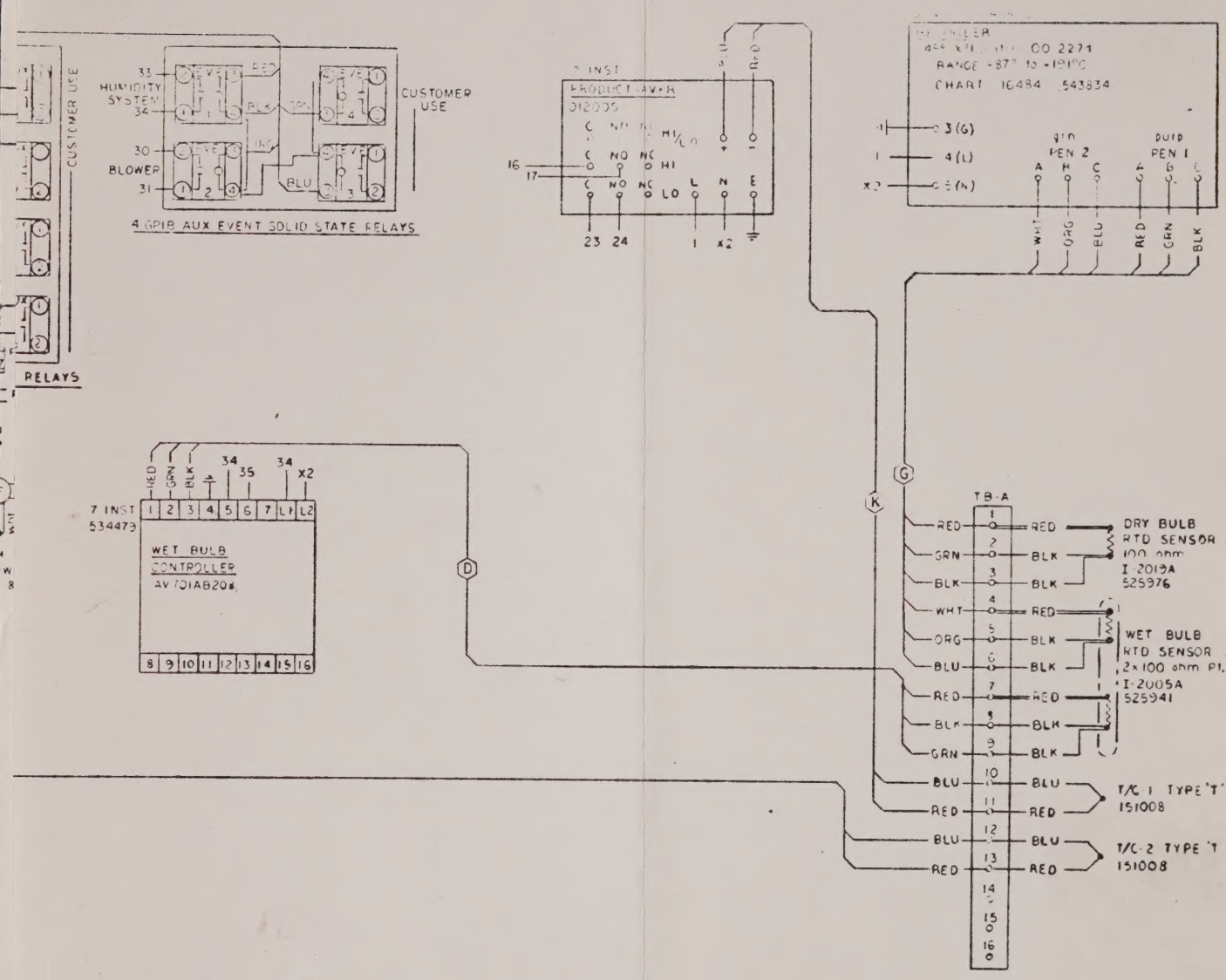
MAGNAVOX
JOB 12433-12435

ELECTRICAL SCHEMATIC
F-74-CHV-30-30

DRAWN BY KEITH BROWER DATE 3-7-75
DRAWING NO E-12433-1
SIZE W

STRIES INC HOLLAND MICHIGAN 49423 U.S.A


CHANNEL 1 TYPE 1
RANGE LOW -57°C
RANGE HIGH +191°C
PROGRAM LOW -87°C
PROGRAM HIGH +191°C
DEFAULT SET PT +20°C
NOTES
1. TB 1 2 ARE ACTIVE HIGH OUTPUTS
2. TB 3 ARE ACTIVE LOW INPUTS
TB 1
TB 2
TB 3
NOTE
JUMPER TB3-8 TO TB3-9 AUTO RESTART FOR MAGNAVOX
33 HUMIDITY SYSTEM
34
30 BLOWER
31
CUSTOMER USE
8 AUX EVENT SOLID STA
662836 GPIB AUX. BOARD
I/O
TB-1
TB-2
*FOR CURRENT OUTPUT
662437 LED DISPLAY
S.P. SEL
LOCAL
REMOTE
NOTE 1
4 INST 678732
DRY BULB CONTROLLER
635200 1 1 4 4 2
TB 1
TB 2
NOTE 2
EMI FILTER
669024
5 INST
POWER SUPPLY
662399
OUTPUT STAGING
662412 1 1 1 1 1
TB 1
TB 2
HIGH HEAT
LOW HEAT
LOW COOL
FULL COOL
BYPASS
MID
CIRCUIT BOARD C
CHASSIS GROUND



CABLE LIST

IDENT	DESCR	
A, B	2 CONDUCTOR	ALPHA 1172 OR EQUAL
C, D	3 CONDUCTOR	BELDEN 8443 OR EQUAL
E	4 CONDUCTOR	BELDEN 8444 OR EQUAL
F, G	7 CONDUCTOR	BELDEN 9430 OR EQUAL
H	10 CONDUCTOR RIBBON	
J, K	TYPE 'TX' T/C EXTENSION WIRE	
L	10 CONDUCTOR ASSEMELY 674035	

NOTES

1. ADD JUMPER J1 IF AUX I/O BOARD IS NOT USED
2. DO NOT GROUND CONTROLLER

MAGNAVOX
JOB: 12433-12435

ARMOTRON

INSTRUMENT WIRING SYSTEM 411 W/781C

DRAWN BY KEITH BREWER DATE 3-4-88

DRAWING NO E-12433-2 SIZE W

GPIB

THERMOTRON

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A SUBSIDIARY OF WEHR CORPORATION
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Holland, Michigan 49423 U.S.A.
Phone (616) 392-1492
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